

Risk Assessment of Contact between Domestic Sheep and Bighorn Sheep on the Bighorn National Forest

INTRODUCTION

The Bighorn National Forest (Bighorn NF) is preparing an Environmental Impact Statement (EIS), herein after referred to as the Big 6, for livestock grazing and vegetative management on five project areas on the Tongue, Medicine Wheel / Paintrock, and Powder River Ranger Districts (Beaver Creek, Goose Creek, Little Horn, Rock Creek, and Tensleep). This risk assessment evaluates the risk of contact between domestic sheep and bighorn sheep under Alternative 1 (No Action), Alternative 2 (No Change - Current Management), Alternative 3 (Proposed Action) of the Big 6, and all remaining sheep allotments on the Bighorn NF not examined under the Big 6.

Under the Big 6, Alternative 1, no domestic livestock grazing would be permitted on any grazing allotment within the analysis area and allotments would be closed to livestock grazing. Under Alternative 2, permitted livestock grazing would continue as prescribed under the current special use permit and under current term grazing permits and associated allotment management plans (AMPs), or, in absence of such a plan, under the annual operating instructions (AOIs) for the remaining allotments. Under Alternative 3, permitted livestock grazing would occur on 43 allotments using design criteria and adaptive management. Currently, there are eight domestic sheep allotments on the Medicine Wheel / Paintrock District, seven on the Powder River District, and none on the Tongue Ranger District. There are no bighorn sheep herds in the vicinity of the domestic sheep allotments on the Powder River District.

Comments and concerns about the proposed action received during the scoping process identified a concern that domestic sheep grazing within the allotments may negatively impact Rocky Mountain bighorn sheep (bighorn sheep) by spreading disease. The proposed action is designed to eliminate physical contact between domestic sheep and bighorn sheep while still retaining opportunities to provide forage to sustain local dependent livestock industry, two of the major issues identified internally and during public scoping.

This Risk Assessment is a supplemental analysis for the Biological Evaluation (BE) prepared for the Big 6 project. Refer to the BE for additional bighorn sheep viability discussions and the 2005 Bighorn National Forest Final Environmental Impact Statement for the Revised Land and Resource Management Plan (Forest Plan).

One of the reasons bighorn sheep warranted sensitive status was the susceptibility of herds to die-offs due to diseases which may be transmitted by domestic sheep or goats. One of the issues identified with domestic sheep grazing on the Bighorn NF is the potential for physical contact between domestic sheep and bighorn sheep.

Free-ranging bighorn sheep are susceptible to many diseases. The most important of these is broncho-pneumonia, which is usually associated with bacteria in the genera *Pasteurella* and *Mannheimia*. Pneumonia caused by these bacteria has produced partial to complete die-offs of bighorn sheep herds across the species' range, with the frequency of die-offs being particularly high in the northwestern US (Monello et al. 2001). Although limited knowledge of transmission dynamics exists (Garde et al. 2005), extensive scientific literature supports a relationship between disease in bighorn sheep populations and contact with domestic sheep. *Pasteurella* is a common organism carried in the pharyngeal area of domestic sheep (Thompson et al. 1977, Frank 1982), but rarely is isolated from healthy bighorn sheep (Dunbar et al. 1990). The literature includes both circumstantial evidence linking bighorn die-offs in the wild to contact with domestic animals, and controlled experiments where healthy bighorn sheep exposed to domestic sheep displayed subsequently high mortality rates (Foreyt 1989, 1990, Foreyt et al. 1994; Onderka et al. 1988; Onderka and Wishart 1988; Garde et al. 2005; Lawrence et al. 2010; Jeffress 1994).

This contact increases risk of subsequent bighorn sheep mortality events and reduces recruitment, primarily due to respiratory diseases (Western Association of Fish and Wildlife Agencies 2010). The complete range of mechanisms and/or causal agents that lead to disease events in bighorn sheep are still under debate, and not all bighorn sheep disease events can be attributed to contact with domestic sheep (CAST 2008, WY State-wide Bighorn/Domestic Sheep Interaction Working Group 2004, Western Association of Fish and Wildlife Agencies Wild Sheep Working Group 2010, Aune et al. 1998, Onderka and Wishart 1984). However, when contact between domestic sheep and wild sheep has been documented, the severity of the wild sheep die-off is typically more pronounced (Aune et al. 1998, Martin et al. 1996). Arguably, much of the evidence is circumstantial; however, the compilation of cases throughout several decades does contribute to an increasing body of evidence that overwhelmingly demonstrates bighorn sheep near domestic sheep are at risk for disease transmission, even though "contact" may not have actually been observed. Monello et al. (2001) state that bighorn sheep herds classified in a "pneumonia induced die-off" category were located significantly closer (<15 miles) to domestic sheep allotments than those in a non-die-off category (>25 miles). George et al. (2008) document a winter die-off in Colorado that affected three bighorn sheep herds that was traced to contact with a single domestic ewe.

These die-offs have prompted management decisions to eliminate shared use of ranges by bighorn and domestic sheep by Federal land management agencies and State wildlife departments (CAST 2008, Goodson 1982). It is prudent to implement management actions to reduce or eliminate the potential for contact between domestic sheep and bighorn sheep (CAST 2008, WY State-wide Bighorn/Domestic Sheep Interaction Working Group 2004, Western Association of Fish and Wildlife Agencies Wild Sheep Working Group 2010).

The purpose of this risk assessment is to profile the current and future viability of bighorn sheep populations on or adjacent to the Bighorn NF and provide the decision maker with an objective evaluation of the risk of contact between domestic sheep and bighorn sheep under the Big 6 EIS, No Action, No Change (Current Management), and Proposed Action alternatives. The decision maker will then use the results of this assessment as an important factor of consideration in their

decision regarding future domestic sheep grazing in the analysis area. The risk assessment evaluates the probability of contact. Contact for this risk assessment is defined as the probability of bighorn sheep and domestic sheep occurrence on active domestic sheep allotments or trailing routes located on the Bighorn NF. It should be noted that other literature or sources may define contact differently.

Short-term and long-term temporal considerations are presented in this risk assessment. In the short-term, the risk assessment will be evaluated every five years or sooner, if warranted. If conditions change, the Big 6 EIS may need review under the National Environmental Policy Act (NEPA). Under the current Planning Rule, there should be a Forest Plan revision concluded no later than 2020. In the long-term, species viability determinations provide an assessment of the likelihood that, if current conditions prevail, the occurrence of the species will persist for a period of time, at least 20-30 years, and sometimes longer, depending on the species or community. Refer to the BE for bighorn sheep and other species viability determinations.

Analysis area maps along with other maps and resources referred to in this analysis are available at the Forest Supervisor's Office located in Sheridan, Wyoming.

RISK ASSESSMENT PROCESS

This risk assessment involved the participation of Interdisciplinary Team members assigned to the Big 6 project including a Wildlife Biologist, Rangeland Management Specialist, Forest Planner, and GIS Specialist. Resource specialists on the Medicine Wheel/Paintrock, Powder River, and Tongue Ranger Districts also provided review and contribution due to their historic knowledge of the project area, domestic sheep grazing allotments, and adjacent bighorn sheep populations. Coordination included a meeting with Wyoming Game and Fish Department (WGFD) personnel early in the process to jointly review current Wyoming bighorn sheep population information within or adjacent to the project area and management goals. The Area Wildlife Biologist for WGFD and Wyoming's Bighorn Sheep Coordinator participated in development and review of the assessment. A Wildlife Biologist and Range Conservationist with the Bureau of Land Management offices in Cody, Wyoming provided contributions on the Devils Canyon bighorn sheep herd. A National Park Service GIS Specialist provided GIS input on the bighorn sheep herd within the Bighorn Canyon NRA. The Big 6 was discussed at public meetings held on October 5 - 6, 2010 in Greybull and Sheridan, Wyoming.

The risk assessment process started with development of design criteria incorporated from other published scientific literature and management recommendations. Those design criteria were assessed for applicability of local conditions for effectiveness of reducing the potential for contact between bighorn and domestic sheep in the areas where Big 6 domestic sheep grazed or trailed, and on potential bighorn sheep habitat on the Bighorn NF, outside the Big 6. Several iterations of this process occurred, with design criteria added and strengthened, in order to improve the effectiveness and likelihood of maintaining separation between bighorn and domestic sheep.

The Big 6 decision affects multiple use objectives on the Bighorn NF, however, this analysis will focus on probability of contact between permitted domestic sheep and bighorn sheep. Therefore, the Big 6 decision may affect domestic sheep grazing through management actions such as maintaining, moving, allocation, or potential closing of sheep allotments, and potential bighorn sheep population and distribution on the Bighorn NF.

LITERATURE REVIEW, RESOURCES, AND MANAGEMENT RECOMMENDATIONS

Due to active domestic sheep grazing allotments, forage reserve allotments, trailing of domestic sheep, and seasonal movements of bighorn sheep, it is important to provide a thorough analysis of potential contact between domestic sheep and bighorn sheep. A review of applicable bighorn sheep literature, resources, and management recommendations considered in this assessment are discussed below.

The documents described below provide suggestions for consideration by land management agencies evaluating domestic sheep and goat grazing within or in proximity to wild sheep range. These documents provide recommendations similar to “best management practices” and as such are not required, but are generally accepted principles for achieving consensus based conservation of bighorn sheep. These documents provide key concepts that can help federal and state land management agencies achieve species conservation goals. All documents were reviewed and key concepts were considered in the development of project design criteria for the analysis.

- **Final Supplemental Environmental Impact Statement and Forest Plan Amendment Identifying Suitable Rangeland for Domestic Sheep and Goat Grazing to Maintain Habitat for Viable Bighorn Sheep Populations (2010).**

This document supported the Payette National Forest’s management decision process and provided the foundation to the rationale used to ensure the maintenance and viability of bighorn sheep populations. The analysis was conducted at the spatial scale of the Payette NF, and entailed a review of the scientific literature on disease transmission from domestic sheep to bighorn sheep and the impacts that disease has on bighorn sheep populations; and an evaluation of population data available for bighorn populations located within and adjacent to the Payette's boundaries.

- **Risk Assessment for the Pagosa Sheep Grazing Environmental Analysis – An Evaluation of Risk of Physical Contact between Domestic Sheep and Rocky Mountain Bighorn Sheep in the Pagosa Sheep Grazing Analysis Area (2010).**

This recent document provided the decision maker with a detailed analysis and objective evaluation of the risk of physical contact between domestic sheep and bighorn sheep under the No Action (no permitted livestock grazing) and Proposed Action (alternative designed to minimize physical contact between domestic sheep and Rocky Mountain bighorn sheep while still retaining opportunities to provide forage to sustain local dependent livestock industry).

- **Western Association of Fish and Wildlife Agencies (WAFWA) Wild Sheep Working Group Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat (July 2010).**

A report published by 19 state and provincial wildlife management agencies that chartered and funded to work collaboratively with livestock industry to reduce the potential for wild sheep die-offs. This report articulates concerns about potential disease transmission between domestic livestock and wildlife, and suggests an array of management approaches to minimize such risks. This report advocates, among other things, that effective separation (both temporal and/or spatial) of wild and domestic sheep should be a primary management goal. Effective separation does not necessarily require the removal of domestic sheep.

- **Devils Canyon Bighorn Sheep Supplemental Transplant and Resource Selection Analysis. 2004-2008. (Easterly 2009).**

This report summarizes the WGFD's efforts to match habitat with source herds of bighorn sheep to improve success of transplanted populations on BLM lands adjacent to the Bighorn NF. Methods of post-transplant monitoring regarding habitat use, seasonal movements, and home range added greatly to the assessment.

- **Rocky Mountain Bighorn Sheep (*Ovis canadensis*): A Technical Conservation Assessment" (Beecham and Reynolds 2007).**

This document was produced for the USDA Forest Service Region 2 Species Conservation Project, and is designed to provide land managers, biologists, and the public with a thorough discussion of the biology, ecology, conservation status, and management of bighorn sheep based on current scientific knowledge.

- **A Process for Finding Management Solutions to the Incompatibility between Domestic and Bighorn Sheep" (Schommer and Woolever 2001).**

This document provides Forest Service staff with recommendations for using a collaborative approach to find management solutions to reduce or eliminate contact between wild sheep and domestic sheep.

- **A GIS-Based Evaluation of the Bighorn Mountains for Reintroduction of Rocky Mountain Bighorn Sheep (Hughes 1997).**

This document provides a model for evaluating the availability and quality of bighorn sheep habitat based upon literature, expert review, personal observations, and GIS. The document evaluates bighorn sheep habitat on the Bighorn Mountains and concludes that lambing habitat is limited, habitat conditions have changed, and do not currently favor reintroduction of bighorn sheep.

- **Shell Canyon Bighorn Sheep Cooperative Management Plan (US Forest Service and Wyoming Game and Fish Department 1991).**

This plan delineated potentially suitable summer and winter bighorn sheep range on and adjacent to the Bighorn NF and concluded that 70 bighorn sheep could live on the winter range in Shell Canyon on a year-long basis, assuming that bighorns will migrate and utilize high elevation ranges during the late spring, summer and early fall. The Plan also stated that if bighorns migrated to higher elevation summer ranges, a population of 200 animals was possible.

- **Shell Canyon Bighorn Sheep Reintroduction Proposal (US Forest Service 1990).**

This document analyzed the proposed reintroduction of bighorn sheep onto historical range in the Shell Canyon area of the Bighorn NF.

STATUS OF BIGHORN SHEEP IN WYOMING

Two species of mountain sheep occur in western North America. Thinhorn mountain sheep (*Ovis dalli*) are found in Alaska and the Yukon, Northwest Territories, and British Columbia in Canada. The bighorn species (*O. canadensis*) was historically distributed from the Canadian provinces of British Columbia and Alberta south to Mexico. Rocky Mountain (*O. c. canadensis*) and a desert subspecies (*O. c. nelsoni*) of bighorn sheep are found within Region 2 of the Forest Service (Beecham et al. 2007). This assessment focuses on bighorn sheep located within Region 2 in Wyoming and specifically, on or adjacent to the Bighorn NF.

Beecham et al. 2007, describes that bighorn sheep populations from the late 1800's through the mid-1990's experienced significant declines across their range as a result of diseases introduced from domestic livestock, unregulated and market hunting, habitat loss, and competition from domestic livestock. In the 1960's, many western states, including those in Region 2, began active bighorn sheep transplant programs in an effort to augment small, remnant sheep populations and to reintroduce bighorns into historic, but vacant, habitat. Although bighorn sheep numbers increased throughout the western United States because of these transplant efforts, periodic die-offs continued to occur in many herds, including those in Region 2.

Despite these risks to population persistence, several areas can be considered strongholds for bighorn sheep in Region 2 (Beecham et al. 2007). Obvious strongholds within Region 2 are found in northwestern Wyoming and south-central Colorado. Herd units in these two areas are well connected, allowing movement between populations; consist of some of the largest populations within Region 2; are free of disease-related die-offs; and occupy habitats where the threat of domestic sheep contact has been removed or dramatically reduced. Seasonal movements are not greatly impaired in these two areas, and habitat quality is not a limiting factor.

In the following paragraphs, Beecham et al. 2007, summarizes bighorn sheep population information provided by the WGFD for Wyoming. Based on this information, they estimated Wyoming bighorn sheep populations at approximately 6,000 individuals.

Shoshone National Forest: 5 herds

The Shoshone National Forest has the largest number of bighorn sheep of any forest in the State, with some 4,000 of the estimated 6,000 sheep statewide occurring on the forest. The five herds include: 1) The Clark's Fork Herd is currently estimated at 425 individuals; 2) the Trout Peak Herd is currently estimated at 435 individuals; 3) the Wapiti Ridge Herd is the third largest bighorn herd in the state, estimated at 1,040 individuals; 4) the Younts Peak Herd currently estimated at 909 individuals; and 5) the Francs Peak Herd is the largest herd in the state, currently estimated at 1,404 individuals.

Bridger-Teton and Shoshone National Forest: 4 herds

Beecham et al. 2007 described the four bighorn sheep herds located on the Bridger-Teton and Shoshone National Forests, as follows: 1) The Whiskey Mountain Herd has undergone a large population decrease and remains in decline. Accurate population estimates have been problematic due to poor population model performance, but a conservative estimate puts the population at 650 animals; 2) The Darby Mountain Herd is an introduced population, currently estimated at 55 individuals; 3) The Temple Peak Herd is an indigenous population of the Bridger-Teton and Shoshone National Forests estimated at 30 to 40 individuals; and 4) the Jackson Herd is one of the few herds whose population trend is decreasing with an estimated population of 318 bighorn sheep.

Medicine Bow-Routt National Forest: 3 herds

All bighorn sheep on the Medicine Bow–Routt National Forest have been reintroduced (Beecham et al. 2007) and include the following herds: 1) The Douglas Creek Herd occupies the Snowy Range and is estimated at about 100 individuals; 2) the Encampment River Herd is one of the most imperiled bighorn sheep populations in Wyoming and currently estimated at about 50 individuals; and 3) the Laramie Peak is the largest bighorn sheep herd on the Medicine Bow – Routt and is estimated at 250 to 300 individuals.

Caribou-Targhee National Forest: 1 herd [Adjacent herd in USFS Region 4]

The Targhee Herd unit (Hunt Area 6) borders Yellowstone National Park in Wyoming and is currently stable with an estimated 100 bighorn sheep.

Bighorn National Forest: 1 herd

Beecham et al. (2007) discussed only one bighorn sheep herd on or adjacent to the Bighorn NF (Devils Canyon) and the publication did not mention the Shell Canyon herd, based on reports provided by the WGFD.

In 1973, 39 sheep from the Whiskey Mountain Herd were translocated to BLM-administered lands in the Devils Canyon Herd unit, where they joined bighorn sheep within the Bighorn Canyon National Recreation Area (Bighorn Canyon NRA) in Montana (Beecham et al. 2007). This remnant population persisted and was estimated at about 50 individuals in 2003. In 2004, 20 bighorn sheep from the Deschutes River in Oregon were translocated to BLM land within the herd unit. This source population was chosen because of its propensity for earlier lambing, a characteristic that was believed to provide an advantage in the environmental conditions found in

the Devils Canyon Herd Unit. In 2006, an additional 20 bighorn sheep from the Missouri River Breaks near Havre, Montana were translocated to the same area as the 2004 release, bringing the total estimated herd size to 110. These sheep were also known to show a propensity for early lambing and were chosen as a source population largely for that reason. Personnel from WGFD expect that the present herd will likely increase and the Devils Canyon herd has recently been used as a source for translocations.

These bighorn sheep were translocated to BLM land rather than the nearby Bighorn NF because of the active domestic sheep allotments found on the Forest. It is possible that a few bighorn sheep, especially rams, from the remnant population in the Bighorn Canyon NRA herd occasionally used areas on the Bighorn NF in past years.

Based on the first two years of observation following the initial translocation, it appears as if the newly introduced herd does not undertake large seasonal movements, which was characteristic of their original source populations. Therefore, habitat improvement projects are in the planning stages for selected areas currently in use, including prescribed burns to reduce decadent sagebrush stands and juniper encroachment and development of water sources.

Other Herds in Wyoming not located on National Forest System Lands: 3 herds

Beecham et al. (2007) describes three bighorn sheep herds in Wyoming which are not located on National Forest system lands, as follows: 1) The Seminoe-Ferris Herd is best described as a remnant herd comprised of only about 15 individuals; 2) The Sweetwater Rocks Herd contains only a handful of bighorns with WGFD observations of six to eight sheep, with another recent unsubstantiated sighting of 35; and 3) the Yellowstone Herd was estimated at 244 sheep in spring 2005 based on helicopter surveys (Beecham et al. 2007).

Although Beecham et al. (2007) states that only three bighorn sheep herds in Wyoming are not located on National Forest system lands, this assessment submits information and data which concludes that the Bighorn Canyon NRA) herd is not located on National Forest system lands, but is immediately adjacent to the Devils Canyon herd and therefore, presents potential risk of contact. Therefore, the Devils Canyon, Shell Canyon, and Bighorn Canyon NRA bighorn sheep herds will be evaluated in this risk assessment. Beecham et al. (2007) further describes the Devils Canyon herd as isolated from other bighorn sheep herds within Wyoming; therefore, no natural interchange should be expected. However, we conclude that the Shell Canyon bighorn sheep herd lives almost entirely on the Bighorn NF and are approximately 12 miles from the Devils Canyon herd. Additionally, the Bighorn Canyon NRA bighorn sheep herd live adjacent to the Devils Canyon herd, therefore; both herds present risk for interchange with the Devils Canyon herd. Beecham et al. (2007) did not mention the Shell Canyon herd in the publication, either by error of omission or possibly since the Shell Canyon herd is not considered a viable population. Beecham et al. (2007) makes references to bighorn sheep within the Bighorn Canyon Recreation Area of Montana, but does not discuss the area of Wyoming (adjacent to the Bighorn NF) inhabited by this bighorn population. The past and current status of the Shell Canyon and Bighorn Canyon NRA bighorn sheep herds will be discussed in the, "Affected Bighorn Sheep Populations" section of this assessment.

OTHER WESTERN UNITED STATES BIGHORN SHEEP STATUS

The WAFWA documented in 2010 (WAFWA 2010) that there were several die-offs of bighorn sheep in Montana, Nevada, Wyoming, Utah, and Washington. Of the nine bighorn sheep herds involved in this die-off from *Pastuerella* and other diseases, only two of the herds were not likely affected by interaction with domestic sheep or goats.

ANALYSIS AREA

The area being analyzed in this assessment encompasses the Bighorn NF which is located in portions of Bighorn, Sheridan, Washakie, and Johnson Counties, Wyoming. Also included is the cumulative effects area boundary which includes areas used off the Bighorn NF by the Devils Canyon, Shell Canyon, and Bighorn Canyon NRA bighorn sheep herds, as practically indicated by radio-collar data shown in Appendix E. This assessment also focuses on the project areas identified in the Big 6 EIS, which is approximately 386,000 acres and contains 43 livestock allotments (Big 6 EIS 2011), of which 15 are domestic sheep allotments. A more detailed description of the current livestock grazing management can be found in the Big 6 EIS, Chapter 2.

The Bighorn Mountains are an isolated range rising from rolling plains country of approximately 4,000 feet in elevation to an elevation of 13,175 feet above sea level at the summit of Cloud Peak. The ruggedly glaciated, barren granite peaks slope off to the more gently rolling, timbered ridges and drainages that constitute the bulk of the Big Horn Mountains. Here the terrain is almost plateau-like, ranging in elevation from approximately 7,000 to 9,000 feet. At the Forest boundary, the terrain drops off suddenly to the surrounding plains and rolling foothills (Forest Plan 2005). All of the watersheds originating on the Bighorn NF drain into the Yellowstone River through the Big Horn, Tongue, and Powder Rivers.

ALTERNATIVES CONSIDERED

The three alternatives described below come directly from the Big 6 EIS and are described in further detail in Chapter 3 of the EIS.

Livestock grazing has been determined by the Forest Plan to be an appropriate use and falls under the multiple-use mandate of the Forest Service (P.L. 86-517, 1960). While the Forest Plan establishes the general suitability of an area for livestock grazing, the decision to authorize livestock grazing on a particular area of land is the outcome of a comprehensive, integrated project-level resource analysis for the particular allotments. An environmental analysis is required in order to authorize livestock grazing in the analysis area, to prescribe site-specific management of the rangeland resources, and to ensure management is capable of meeting or moving toward desired conditions. Analysis and associated decisions made at this level are documented in an Environmental Assessment (EA) or EIS, and a decision document, and implemented through the grazing permit, AMP and AOIs.

Table 1 describes domestic sheep grazing numbers proposed under Alternative 1 (No Action), Alternative 2 (No Change – Current Management), and Alternative 3 (Proposed Action).

Table 1. Domestic Sheep Grazing by Alternative for the Beaver Creek and Tensleep Project Areas.

Allotment	Alternative 1	Alternative 2	Alternative 3
Beaver Creek Project Area (Medicine Wheel – Paintrock District)			
Antelope, Bear – Crystal, Beaver	0	1600	1600
Grouse Creek	0	0	Cattle
Hunt Mountain	0	0	Forage Reserve
Little Horn S&G	0	1200	1200
Red Canyon S&G	0	0	Forage Reserve
Whaley Creek	0	1030 - preferred applicant	Should all or part of allotment become vacant,-use as-either-forage reserve, incorporate all or part into adjacent sheep allotments, or use H. Falls pasture with adjacent BLM rotation.
Tensleep Project Area (Powder River Ranger District)			
Allotment	Alternative 1	Alternative 2	Alternative 3
Baby Wagon	0	520	520
Garnet	0	1250	1250
Leigh Creek	0	sheep would graze under annual authorization from adjacent Upper Meadow allotment	Leigh Creek S&G would continue to be grazed with Upper Meadows S&G
Hazelton	0	1000	1000
McLain Lake	0	sheep would graze under annual authorization from adjacent Baby Wagon allotment	McLain Lake S&G would continue to be grazed with Hazelton and Baby Wagon S&G
Upper Meadows	0	1200	1200
Willow	0	sheep would graze under annual authorization from adjacent Upper Meadow allotment	Willow S&G would continue to be grazed with Upper Meadows S&G
Gold Mine Trailing	Not used	Used	Used

Table 2 describes domestic sheep grazing allotments, year last stocked, sheep numbers, and season of use on year last stocked with sheep on all Bighorn NF sheep allotments not within the Big 6 project area.

Table 2. Description of Domestic Sheep Grazing by Allotment on the Medicine Wheel/Paintrock, Powder River, and Tongue Ranger Districts, not within the Big 6 Project Area.

Allotment	Year last stocked	Authorized Sheep numbers	Authorized Season of Use
Medicine Wheel / Paintrock District			
Wallrock/Hidden Teepee	2010	707 Ewe/lamb 549 yearlings	7/1-9/30 963 AUMs
Pole Creek	2010 One band run in rotation across both Pole Creek and Little Horn S&G	716 Ewe/lamb	7/6 – 9/30 644 AUMs total for both Pole Cr and Little Horn S&Gs
Paintrock C&H&S	NA, has been stocked with cattle since 1923. In 1974, two sheep allotments were converted to cattle and added to the allotment. The 1991 EA says could stock 4 high elevation pastures with sheep, but this has not occurred.	NA	NA
Medicine Lodge Dry Fork C&H S&G	Permit allows variable numbers, season, kind which can occur on an annual basis. 2003 stocked with sheep and cattle for season. Use of one pasture occurred in 2004 with sheep. Primarily stocked with cattle in all years.	900 ewe/lamb2003 220 yearlings2003	7/07-9/152003 733 AUMs sheep 2003
Powder River District			
Crazy Woman	2010	Sheep from adjacent Baby Wagon allotment graze under annual authorization 1500 Mature Sheep	07/11 – 08/31
Elk Lake	1969	This allotment was not permitted at time of wilderness designation, so may not be available for permitted sheep grazing under FS wilderness regulations. 1317 Mature sheep	07/01 – 08/31
Cloud Peak	1969	These allotments were not permitted at time of wilderness designation, so may not be available for permitted sheep grazing under wilderness FS regs. 1317 Mature Sheep	07/01 – 08/31

Allotment	Year last stocked	Authorized Sheep numbers	Authorized Season of Use
Crazy Woman Stock Driveway	2010	6000 Mature Sheep	10/11 – 10/12
Tongue District			
Lookout Mountain	From Tongue AMP decision, has been allocated to C&H allotments.	N/A	N/A
Bull/Woodrock	2010	1450 Ewe/Lamb 270 Mature	7/1/ - 9/30 1415 AUMs
Owen Creek	2010	1100 Mature	7/13 -9/17 727 AUMs
Fishhook/Fool	2010	1140 Ewe/lamb	7/6 – 9/18 843 AUMs

Alternative 1 – No Action

The No Action alternative is the same as “no domestic livestock grazing” and means that domestic livestock grazing would not be authorized within the project area. Therefore, under Alternative 1, no domestic livestock grazing would occur. The effects of this action are further disclosed in Chapter 3 of the EIS. Potential effects of the No Action Alternative are also discussed in this assessment under the section entitled, “Potential Scenarios Considered for Changed Conditions with the Abundance, Distribution, and Viability of the Shell Canyon and Devils Canyon Bighorn Sheep Herds.”

Alternative 2 – Current Livestock Grazing Management

Under Alternative 2, livestock grazing would continue as prescribed under current term grazing permits and associated Allotment Management Plans (AMPs) or, in the absence of such a plan, under the Annual Operating Instructions (AOIs). Permitted livestock grazing would also continue under the current special use permit for the Tourist Horse allotment (see EIS for detailed descriptions). Existing improvements would be maintained as assigned in term grazing permits and would be reconstructed as needed. New improvements not currently authorized under a NEPA decision would not be developed without further NEPA analysis and decision. Improvements on vacant allotments would be removed if no longer needed for wildlife or livestock grazing. Table 3 describes current permitted sheep allotments with numbers of sheep, sheep class (mature sheep, ewe/lambs, or NA), season of use, and AUMs (Big 6 EIS).

Table 3. Summary of Current Permitted Domestic Sheep Management on the Big 6 Allotments.

Allotment	Permitted # Sheep	Sheep Class	Permitted Season of Use	Permitted AUMs
Beaver Creek Project Area (Medicine Wheel – Paintrock District)				
Antelope, Bear – Crystal, Beaver	1600	Mature	7/6 - 9/30	915
Grouse Creek	NA – not grazed	NA	NA	NA

Allotment	Permitted # Sheep	Sheep Class	Permitted Season of Use	Permitted AUMs
	by sheep since 1990			
Hunt Mountain	NA - vacant	N- A	NA	NA
Little Horn S&G	1200	Mature	7/6 - 9/15	852
Red Canyon S&G	NA - vacant	NA	NA	NA
Whaley Creek	1030 - preferred applicant status at time of EIS.	Mature	6/26 - 9/15	833
Tensleep Project Area (Powder River Ranger District)				
Baby Wagon	520	Mature	7/11 - 8/31	267
Garnet	1250	Ewe/lamb	7/8 - 9/12	826
Hazleton	1000	Ewe/lamb	7/6 - 9/5	612
Leigh Creek	NA – annual authorization w/ Upper Meadows	Ewe/lamb	7/1 – 8/23	None
McClain Lake	NA – annual authorization w/ Hazelton	Ewe/lamb	7/6 – 9/05	None
Upper Meadows	1200	Ewe/lamb	7/1 to 8/23	639
Willow	NA – annual authorization w/ Upper Meadows	Ewe/lamb	7/1 – 8/23	None
Gold Mine Road	Trailing Only			

Alternative 3 – Proposed Action for Livestock Grazing Management

Alternative 3 proposes to implement all applicable standards and guidelines from the Forest Plan (2005) and the design criteria and adaptive management strategies shown below and in Chapter 2 of the EIS. Alternative 3 incorporates the use of design criteria and adaptive management strategies, based on monitoring, that are designed to reach or maintain desired resource conditions. Desired resource conditions (as displayed in the EIS) also include maintaining the viability of the Devils Canyon bighorn sheep herd, defined as a minimum population of 125 animals. Alternative 3 encompasses the adaptive management process which allows for dealing with uncertainty and changing conditions over time, and focuses on the end results of meeting or moving towards desired conditions. In the context of the EIS and this assessment, this means that a course of action (design criteria) is selected as a starting point that is believed to best meet or move toward the desired objectives. Monitoring would occur that evaluates effectiveness of design criteria and adaptive management strategies. The Interdisciplinary Team and the Line Officer will use the monitoring results to make adjustments to management as needed, to ensure adequate progress toward the desired conditions. All adaptive actions will be within the scope of effects documented in the Forest Plan (2005) and Big 6 EIS. For Alternative 3, the design criteria applicable to bighorn sheep described below are management requirements that establish allowable limits for range management activities on allotments. These measures should maintain

desired conditions where the desired conditions are presently being met or improve conditions that are not currently at the desired condition. A complete list of all design criteria for this project can also be found in the Big 6 EIS. Adaptive management strategies listed would be implemented progressively based on need determined by the USFS.

Big 6 Design Criteria and Adaptive Management Strategies Applicable to Maintain Separation between Domestic and Bighorn Sheep

The following are the proposed measures that are included in Alternative 3 (Chapter 2) section of the FEIS that would be implemented if this alternative is selected. These design criteria were taken from scientific literature and other published management recommendations that validate the effectiveness of these measures (refer to Appendix A).

Definitions:

Design Criteria: a requirement that is incorporated in the proposed action to reduce impacts of proposed activities with the intent to meet, maintain, or move the resource toward desired objectives.

Adaptive Management Strategies: a variety of “tools” or actions (based on monitoring) which allows for dealing with uncertainty and changing conditions as needed, and focuses on the end results of meeting or moving towards desired conditions.

Contact: the probability of bighorn sheep and domestic sheep occurring at the same time on active domestic sheep allotments or trailing routes, which includes buffered areas where domestic sheep may possibly stray.

The following lists the specific design criteria within the Big 6 project area.

Design criteria applicable to all domestic sheep allotments:

- Require a full time herder for each band of sheep.
- Sheep shall be bedded in a new location every 1 to 3 days to avoid leaving bed grounds with little residual vegetation and/or trampled soils. Bed grounds should be relocated annually where possible.
- Sheep shall be open herded, and grazing periods in each area would vary from one to ten days before camp is moved.
- Sheep shall avoid re-grazing areas previously grazed in the rotation.
- Avoid bedding, watering, and corralling sheep within eligible historic properties.
- Salt only sufficient amounts, so that surplus is not left behind after domestic sheep leave the area to minimize attraction to wildlife species.
- When bighorn sheep are in visible proximity or are known to come in contact with domestic sheep, the permittee or Forest Service personnel shall immediately notify the WGFD with the location and description of the bighorn sheep. The Forest Service and the WGFD will cooperatively re-establish effective separation.

- The Forest Service and WGFD shall provide photos of bighorn sheep, with written information of the potential domestic/bighorn sheep contact issues, printed in both English and Spanish to permittees in their Annual Operating Instructions for distribution to their herders.
- Forest Service shall provide signing for the Shell Canyon herd and Devils Canyon herd habitat areas informing the public on the domestic/bighorn sheep contact issue and to provide reporting guidance of any bighorn sheep/domestic sheep contacts observed.
- The Risk Assessment for potential contact between domestic and bighorn sheep shall be re-examined after five years or sooner, if conditions or information warrant, validating the information and associated management practices considered. The Forest Service, WGFD, and permittees will cooperatively assess the changed conditions to determine management actions needed.
- The WGFD and Forest Service will cooperatively monitor the Devils Canyon bighorn sheep herd to detect expansion of the sheep herd and/or potential interaction with domestic sheep.

Design criteria applicable to vegetation management:

- For any prescribed fire management actions along the western FS boundary north of Highway 14, the Forest Service shall coordinate with WGFD and BLM to manage vegetative structure to achieve bighorn sheep management objectives. This is intended to minimize potential contact between the Devils Canyon and Shell Canyon bighorn herds, and/or contact between bighorn and domestic sheep.

Design Criteria to address the potential for contact between domestic goat/sheep not associated with livestock allotments and bighorn sheep near the Devils Canyon herd:

- Use Special Order authority and associated signing to close the areas west of Forest Roads 11 and 14 and north of Highway 14A to recreational goat packing to reduce potential contact with bighorn sheep. Similarly, do not allow goat or sheep in this area for weed or brush control purposes.

Design criteria applicable to domestic sheep trailing along Highway 14A to minimize potential contacts between domestic sheep and the Devils Canyon bighorn sheep herd:

- Stray domestic sheep shall be removed by the permittee from the trailing route.
 - To minimize the potential for stray sheep associated with trailing, a count of sheep shall be taken immediately prior to entry on Forest, and a subsequent count shall be taken immediately upon entry to the authorized grazing allotment. If sheep are trailed off the Forest, a count of sheep shall be taken immediately prior to trailing from the allotment and a subsequent count shall be taken immediately upon exit of the Forest.

- Counting locations shall occur where it is conducive to obtaining the most accurate count. In addition, a count of any sheep added or removed during the season (such as weaning, incorporating bucks, etc) and known losses to predation, or other natural causes shall be reported at the end of the season to help determine if stray domestic sheep are left on the trailing route. These counts will provide the most accurate information; however, it is understood that a small percentage difference in count (less than 1%) could occur due to unknown death losses or miscounting. If stray domestic sheep are suspected from the band, the permittee shall immediately notify the Forest Service and will conduct a search for any stray sheep.
- The Forest Service shall notify the WGFD of intended livestock trail on/trail off dates along Highway 14A. A field evaluation or monitoring flight of the trailing route and nearby vicinity shall be conducted by WGFD and/or FS personnel within 10 days of trailing to search for bighorn sheep, with particular emphasis nearest to the trailing date. The USFS shall consult with WGFD if bighorn sheep are present in the trailing area prior to issuing permission to the permittee(s) for livestock trailing. If bighorn sheep are within the area during trailing, the WGFD will be notified immediately. The USFS and WGFD will jointly determine methods to prevent potential contact, considering the timing issues inherent to livestock trailing (e.g. weather).

The following lists specific adaptive management strategies within the Big 6 project area:

Adaptive Management Strategies applicable to all domestic sheep allotments:

- If permittee notification to USFS or WGFD of bighorn sheep near domestic sheep is delayed due to lack of communication options, permittee(s) will utilize SPOT GPS devices or other technology to improve notification, which can be provided by entities other than the permittee(s). It is noted that herders on the Big 6 allotments currently utilize cell phones for contact with permittee(s).

Adaptive Management Strategies applicable to domestic sheep allotments and trailing routes near the Devils Canyon bighorn sheep herd.

- If counting of domestic sheep or other monitoring indicates stray domestic sheep from trailing, use additional herder(s) as a sweeper behind trailing activities.
- If domestic sheep are known to stray from bed grounds during trailing along Hwy 14A, or if bighorn sheep are known to be near the bed grounds, construct temporary and/or permanent holding facilities, as appropriate on Bighorn NF lands to reduce potential contacts with bighorns. Encourage adjacent land cooperators to similarly construct these facilities.
- If domestic sheep are known to stray during trailing along highway 14A or during use of allotments, increase the use of guard dogs, marker sheep, additional herders, or other

methods necessary to reduce stray domestic sheep. It is noted that permittees currently mark their sheep prior to coming onto the Forest for ownership identification.

- Should confirmed contact (see definition: page 11) of domestic sheep with the Devils Canyon bighorn herd occur associated with domestic sheep trailing, the USFS would assess with WGFD the cause of the contact. If it is domestic sheep strays from trailing and other design criteria or adaptive strategies have failed and WGFD's efforts do not effectively keep bighorn sheep away from Highway 14A, trucking will be required.
- Move permitted domestic sheep near the Devils Canyon bighorn sheep herd to C&H or S&G allotments that become vacant in the future to improve separation, if design criteria or adaptive management strategies fail.
- Remove domestic sheep within the Big 6 project area, near the Devils Canyon bighorn sheep herd, if contact occurs between bighorn sheep and domestic sheep on the domestic sheep allotments, and/or based on failure of other design criteria or adaptive management strategies.

Additional Adaptive Management Strategies Considered

Appendix A (Disease Transmission Risk Reduction – Factors Considered) provides a suite of management considerations evaluated by the Interdisciplinary Team. Proposed risk factors or other approaches are summarized by potential action, discussion, and disposition.

Alternative/design criteria and adaptive management strategies considered for the Big 6 project and forest-wide contexts for the Shell Canyon (SC) and Devils Canyon (DC) bighorn sheep herds are listed in Appendix A. Adaptive management strategies that would have implications on allotments outside those considered in the Big 6 may require additional NEPA analysis prior to implementing.

Wyoming Game and Fish Department Protocol for Handling Comingling of Bighorn Sheep and Domestic Sheep/Goats (WGFD April 2005), Appendix C, WAFWA Guidelines (July 2010).

These WGFD strategic actions were developed as written strategy to address dispersing or wandering bighorn sheep and apply across Wyoming. While these are not Big 6 design criteria and Forest Service controlled actions, they are corresponding strategies to clearly identify what and when specific actions are to be taken (e.g. kill and medically evaluate wandering wild sheep) and specify who is authorized to take those actions, used by the WGFD. These could be considered 'cumulative actions' that are in addition to the actions shown in Chapter 2 of the EIS.

- **Wandering Bighorn Sheep:**
Where there is known, suspected, or likely contact by a wandering bighorn sheep with domestic sheep/goats:

If possible, that bighorn(s) should be live-captured and transported (one-way) to the Sybille Research Unit.

If that bighorn(s) cannot be live-captured, that bighorn(s) should be lethally removed (per authority of chapter 56) and, if possible, transported (either whole or samples) to the Sybille Unit or the WGFD laboratory in Laramie.

- **Stray Domestic Sheep/Goat:**

Where there is known, suspected, or likely contact by a stray domestic sheep/goat with bighorn sheep:

The owner of such livestock should be notified and asked to remove the stray sheep/goat to eliminate the threat of disease transmission; however, it will be the owner's prerogative to determine what course of action should be taken (Wyoming State Statute Title 11 Chapters 19 and 24).

- **Reporting:**

All documented commingling and any actions taken must be reported to the employee's immediate supervisor, Wildlife Administration, as well as the Bighorn Sheep Working Group Chairman, presently Doug McWhirter.

Additional WGFD measures to prevent comingling of bighorn sheep with domestic sheep/goats (Hurley and Easterly, pers. comm.).

- WGFD does not want the Shell Canyon bighorn sheep herd to mix with the Devils Canyon herd, as the Shell Canyon herd is considered "exposed" to domestic sheep.
- WGFD pro-actively captured sheep from the Devils Canyon herd when bighorns were beginning to establish home range close to the Hwy 14A domestic sheep trailing area, and may conduct additional captures if necessary. WGFD could choose to haze bighorn sheep as well.
- WGFD has designated Cottonwood Canyon (North of Highway 14A) as the southernmost area Devils Canyon bighorn sheep will be allowed to deter potential comingling with domestic sheep/goats.
- WGFD has implemented a limited number of hunting permits for rams to remove a small number of Devils Canyon bighorn sheep. In addition, they have the authority from the Wyoming Game and Fish Commission to sell ewe permits as an additional "tool" to regulate the size and density of the herd, and WGFD's objective is to maintain the Devils Canyon bighorn sheep population at viable levels, but vigorously make certain dispersal is low. Population levels can be managed thru hunting and translocations, as high populations increase the potential for dispersal and therefore, interaction with domestic sheep/goats.
- WGFD biologists specifically selected non-migratory sources of bighorn sheep to augment the Devils Canyon herd to avoid risks of movement of bighorn toward domestic sheep allotments. These sheep are better adapted to lower elevation habitat and should lamb earlier to coincide with vegetative green-up in the mountain foothills near the Big Horns.

- WGFD is pro-actively working with the BLM and Forest Service regarding vegetative management using prescribed fire (burning) to improve and facilitate habitat use and movement or “hold” animals in an area.
- WGFD coordinates with other agencies (BLM and Park Service) to buffer potential bighorn sheep interaction areas from domestic goats, when goats are used as weed control.

AFFECTED BIGHORN SHEEP POPULATIONS

Management of Bighorn Sheep on or Adjacent to the Bighorn NF

Three populations of bighorn sheep; the Shell Canyon herd, Devils Canyon herd, and Bighorn Canyon NRA herd, live on or adjacent to the Bighorn NF. Depending upon the herd, individuals from these populations may be present on the Forest in the following ways: 1) throughout most of the year or seasonally on the Bighorn NF, 2) may occur infrequently, as during exploratory excursions, or 3) live adjacent to and have never been known to occur on the Bighorn NF. The management and viability of each herd will be discussed individually.

There is no herd management plan prepared by the WGFD that documents population objectives for all three herds. Herd management goals are documented in Job Completion Reports (WGFD 2009), but only the Devils Canyon herd is included. This is because the Shell Canyon herd is not managed with objectives by WGFD, and the Bighorn Canyon NRA herd is mostly located in Montana and would be under Montana State responsibility (T. Easterly, pers. comm.).

The WGFD have designated core bighorn sheep populations in Wyoming and determined viability regarding herd size. The WGFD has designated areas in Wyoming for bighorn sheep management which include; Bighorn Sheep Core Areas, Cooperative Review Areas, Bighorn Sheep Non-Emphasis Areas, and Bighorn Sheep Non-Management Areas (Wyoming State-wide Bighorn/Domestic Interaction Working Group 2004). The Bighorn NF is located in WGFD’s “non-emphasis” bighorn sheep area, which would incorporate the Shell Canyon herd (Easterly 2011). These are the lowest priority areas for bighorn sheep management in Wyoming and include the Salt River and Bighorn Ranges. No additional effort will be made to prioritize or emphasize bighorn sheep by the State unless agreed to by the statewide Domestic/Bighorn Sheep Interaction Working group. Also under the WGFD’s guidelines in non-emphasis areas, existing bighorn sheep populations will not be protected at the expense of domestic sheep grazing (Wyoming State-wide Bighorn/Domestic Interaction Working Group 2004). The Devils Canyon herd is within the “cooperative review” area, meaning actions to benefit this bighorn herd would be done in conjunction with other partners. The Bighorn Canyon NRA Area herd would similarly fall within the “cooperative review” area.

The Wyoming State-wide Bighorn/Domestic Interaction Working Group provided recommendations and guidance for relocating domestic sheep from the Shoshone National Forest onto the Bighorn NF, which was accomplished to enhance the native core herds of bighorn sheep on the Shoshone National Forest. The relocation of this band of domestic sheep from the Shoshone National Forest to the Bighorn NF also facilitated the biological objectives established

for the grizzly bear and gray wolf (Threatened and Endangered Species) by reducing potential sheep predation and the resulting mortality of grizzly bears and gray wolves.

Because of the non-emphasis status and relocation of domestic sheep onto the Bighorn NF, the Bighorn National Forest's 2005 LRMP does not emphasize managing for bighorn sheep on Forest lands. However, recognizing bighorn sheep are a Forest Service Rocky Mountain Region sensitive species and the obligations under the NFMA and implementing regulations, this assessment contains design criteria for domestic sheep management on Forest lands to assist with management of bighorn sheep.

A bighorn sheep herd size of approximately 125 individuals is considered a viable population by WGFD (K. Hurley, pers. comm.) and most managers (Smith et. al 1991), because this herd size is considered to be the minimum number that is generally believed to contain the genetic diversity to enable persistence of the populations over the long-term.

Shell Canyon Herd

Bighorn sheep were once common on the Bighorn Mountain Range. In 1876, several bighorn sheep were killed by General Crook and his soldiers while on a climb to Cloud Peak. By 1960, only one herd of bighorn sheep remained on the Bighorn NF, the Paintrock herd. Between 1940 and 1974, a total of 128 bighorn sheep were transplanted to the Bighorn Mountains, which include the following: Middle Crazy Woman (39 bighorns), Paintrock drainage (50 bighorns), and Devils Canyon area (39 bighorns), Land and Resource Management Plan – Bighorn National Forest 1985 (LRMP 1985) (Hurley 1996). By 1975, the Crazy Woman herd had disappeared and the Paintrock herd had declined to approximately five sheep. By 1985, no bighorn sheep were known to exist from the Paintrock herd.

The most recent reintroduction efforts on the Bighorn NF began in 1984 with a Range and Wildlife Program Review which included past, present and suitable bighorn sheep range on the Forest (Gibson 1985). Shell Canyon, Middle Crazy Woman and the Paintrock Drainage were identified as areas on the Bighorn NF with potentially suitable habitat for bighorn sheep and this information was incorporated into the LRMP 1985. In 1987, subsequent to the 1985 Forest Plan's bighorn sheep habitat capability analysis, interagency efforts by the Forest, BLM, and WGFD began renewed efforts to discuss potential bighorn sheep transplants into the Shell Canyon area. In cooperation with the WGFD, the Bighorn NF completed an environmental assessment and proposal to reintroduce bighorn sheep onto their historical range in the Shell Canyon area (Shell Canyon Bighorn Sheep Reintroduction Proposal 1990). The EA permanently restricted livestock use to cattle and horses on the Granite Creek C&H, Salt Creek C&H, Sunlight Mesa C&H, and Cedar/Prospect C&H allotments. The Bighorn NF and WGFD also collaborated on the Shell Canyon Bighorn Sheep Cooperative Management Plan (1991). WGFD wildlife biologists concluded that 70 bighorn sheep could live on the winter range in Shell Canyon on a year-long basis, and assumed that bighorn sheep would migrate and utilize high elevation ranges during late spring, summer and early fall. Under these assumptions, a population of 200 bighorn sheep, was possible. Potential contact with domestic sheep that could transmit diseases to bighorn sheep was not considered in the reintroduction proposal (1990) or the EA (1991).

These efforts collectively resulted in the most recent attempts to bring back native bighorn sheep to the Bighorn NF, which took place between 1992 and 1994. During this time period, a total of 111 bighorn sheep were released in the Shell Canyon area from bighorn sheep sources including the Whiskey Basin herd near Dubois, WY and from bighorn sheep captured near Challis, ID (T. Easterly, pers. comm.). Habitat improvements (prescribed burning and water developments), interpretive signing and livestock restrictions within the approximate 9,000 acres were implemented, as outlined in the Environmental Assessment (Shell Canyon Bighorn Sheep Reintroduction Proposal 1990 and the Shell Canyon Bighorn Sheep Cooperative Management Plan 1991).

Following the reintroduction efforts, habitat use and mortality were documented through an inventory conducted in the spring of 1994, with an estimated 81 sheep present resulting from a 27% mortality rate. Currently, a small herd of approximately 10 – 15 bighorn sheep continue to remain in the Shell Canyon area as a result of this release effort. This small herd is the only wild bighorn sheep population known to persistently occur on the Forest. One to two lambs have been seen with this herd each year, indicating there is limited reproduction occurring. Currently, the WGFD is not actively managing this remnant population for a huntable/viable population (WGFD 2007).

Definitive reasons for the bighorn sheep die-offs in the Shell Canyon area are unknown, however wildlife biologists believe that since approximately three-quarters of the transplanted animals came from a bighorn sheep population that had suffered from a pneumonia outbreak, these sheep may not have been in good health to begin with, as die-offs occurred in the Whiskey Basin herd in 1991, the year prior to the first transplant to Shell Canyon (T. Easterly, pers. comm.). Another hypothesis is the Shell Canyon herd interacted with domestic sheep located on the Bighorn NF or adjacent private lands, which may have caused some of the mortality (T. Easterly, pers. comm.). The interaction between Shell Canyon bighorn sheep and domestic sheep on or off the Forest has not been verified by WGFD or Forest Service wildlife biologists, but has been reported. Other causes of mortality documented included predation from mountain lions.

In March of 2008, WGFD radio-collared three bighorn sheep (1 ewe and 2 yearling rams) in Shell Canyon to determine seasonal movement patterns (Easterly 2010). The ewe died in the Spring of 2009 (unknown cause of death) and the collar (#803) was retrieved and location data downloaded. One collar dropped (as scheduled) from one of the two rams (#809). The remaining ram's collar has not been recovered. Location data (position and date) of ram #809 indicate this ram rarely left the Bighorn NF, but made one trip over a two day period to the north during the breeding season (late Nov – early December). The other radio-collared ram was believed to be with this ram approximately 80 - 90% of the time (T. Easterly, pers. comm.). The ewe remained in Shell Canyon most of the time (Easterly 2010).

Domestic sheep occur within 1.4 miles of the Bighorn NF boundary on private lands along Shell Creek (Appendix E). Movement data collected from those radio-collared bighorn sheep indicates that bighorn sheep have been within ½ mile of these domestic sheep, suggesting potential for interaction. Movement data also reflects overlap with Forest Service domestic sheep allotments. Radio telemetry data and wild sheep observations indicate that the Shell Canyon herd primarily use the Forest, but are known to travel off Forest at various time of the year.

The vegetative habitat in Shell Canyon is primarily open shrub communities on the south facing slopes, and has been maintained as such through prescribed burning and wildfires. North facing slopes are heavily forested and may provide barriers to movement for bighorn sheep. A few of the observations tracked through telemetry also suggest movement potential along the steep west faces of the range in the foothills, north towards Devils Canyon. A USFS employee reported sighting a bighorn sheep that may have been from this herd in Tensleep Canyon. WGFD and USFS employees attempted to locate this sheep and were not able to locate it.

Presently, WGFD biologists do not want individual bighorn sheep from the Shell Canyon herd to connect or intermingle with the Devils Canyon herd. It is assumed that the surviving members of the Shell Canyon herd have been exposed to domestic sheep, therefore, if physical contact occurs with other bighorn sheep, the potential exists for transmission of diseases (K. Hurley, pers. comm.). If the remaining members of the Shell Canyon bighorn sheep herd have survived over time with exposure to domestic sheep, it is possible that members of this herd may have developed some level of disease resistance. However, this potential resistance to disease exists currently as a hypothesis and management value or future applicability is unknown at this time (K. Hurley, pers. comm.).

In summary, the Shell Canyon herd consists of approximately 10 - 15 bighorn sheep. This herd is not considered a viable population for management by the Forest or WGFD. WGFD is currently working to maintain effective separation between the Shell Canyon herd and the Devils Canyon herd. WAFWA (2010) defines effective separation as the spatial and/or temporal separation between bighorn sheep and domestic sheep or goats, resulting in minimal risk of contact and subsequent transmission of respiratory disease between animal groups. Potential for the Shell Canyon bighorn sheep herd to interact with domestic sheep exists year-round on private lands bordering the Bighorn NF near Shell, WY and with domestic sheep that are seasonally trailed and grazed on the Forest system lands.

Devils Canyon Herd

The Devils Canyon bighorn sheep herd predominantly resides on lands administered by the BLM which encompasses approximately 19,000 acres within the Devils Canyon area. The remaining lands in which this herd of bighorn sheep inhabit the Devils Canyon area, are state trust lands, private lands owned by E.O. Bischoff Ranch (Easterly 2009), and a limited amount of occupancy occurs on the Bighorn NF (approximately 3%). This area contains several major drainages; Trout Creek, Deer Creek, Porcupine Creek, and Spring Creek and ranges between 4900 to 7200 feet in elevation (Easterly 2009).

In 1973, WGFD released 39 bighorn sheep from Whiskey Mountain on the south side of Devils Canyon. Some of these bighorn sheep reportedly moved down Devils Canyon, crossed Bighorn Canyon (Yellowtail Reservoir), and joined with bighorn sheep later released into the Pryor Mountains (Montana) to establish a population at the Bighorn Canyon National Recreation Area (Easterly 2009). The remainder of the bighorn sheep crossed to the north side of Devils Canyon and established a small population. Easterly (2009) reported that the BLM and WGFD knew very little about habitat use, limiting factors, or reproductive and survival rates of this small, isolated population.

In 1973, bighorn sheep experts had estimated that the Devils Canyon area provided adequate habitat for approximately 200 bighorn sheep. Thirty years after the transplant, however, WGFD estimated that only 30-50 sheep inhabited the Devils Canyon area. The bighorn sheep herd in Devils Canyon did not migrate to alpine habitats during summer. Perhaps the Devils Canyon herd had not increased in numbers due to their inability to adapt to xeric vegetation communities (Easterly 2009). There were also documented observations of bighorn sheep near Devils Canyon with domestic sheep in the 1980s. Conceivably, those bighorn sheep may also have been exposed to domestic sheep (T. Easterly, pers. comm.)

The plan to supplement the Devils Canyon population began in the mid 1990s with BLM and WGFD personnel, as they worked on allotment management plans for the Devils Canyon area. The plans to augment the population increased during the early 2000s and transplants began in 2004. During 2004, 20 bighorn sheep (14 ewes, 3 lambs, 3 rams) were transplanted onto the Devils Canyon areas from Oregon stock on December 4, 2004. An additional 20 bighorn sheep (13 ewes, 5 lambs, 2 yearling rams) were also released on January 19, 2006, from a herd source from Montana. The transplant herds were selected from non-migratory (in elevation) bighorn sheep sources that would more likely remain within the Devils Canyon area, and not migrate onto private lands or the Bighorn NF (K. Hurley, pers. comm.).

The BLM personnel worked cooperatively with WGFD, grazing permittees and other stakeholders to improve bighorn sheep and other wildlife habitat conditions by treating sagebrush/juniper and mountain shrub communities in a mosaic pattern with prescribed fire on the west slope of the Bighorn Mountains. Areas near the Moss Ranch, Little Mountain, Mexican Hills, Cottonwood Canyon and the Bighorn NF boundary were treated to improve suitable habitat for the Devils Canyon sheep population. These habitat enhancement projects may allow bighorn sheep to use treatment areas longer or more often than if untreated (J. Mononi, pers. comm.).

These efforts were conducted to assist in retaining the bighorn sheep within the core BLM use area. Additionally, the WGFD cooperated with USDA Wildlife Services to remove coyotes prior to each transplant and before lambing season in an effort to reduce predation within the core BLM use area. One potential obstacle for continued habitat improvement and desirable habitat conditions for bighorn sheep across the west slope is that, sheep may expand outward from existing core areas, especially if herd numbers increase, and may lead bighorn sheep closer to domestic sheep (J. Mononi, pers. comm.).

The WGFD estimates that approximately 160 bighorn sheep occupy the Devils Canyon area, and managers have a long-term herd objective of about 200 sheep (K. Hurley, pers. comm.). WGFD had hoped that introducing bighorn sheep from xeric, canyon habitats into Devils Canyon would improve reproductive and survival rates. Various herds of bighorn sheep in Oregon, Montana and other states have flourished in habitats similar to Devils Canyon. The population remains viable; however, the potential for contact between bighorn sheep and domestic sheep exists at the southern end of the Devils Canyon area where domestic sheep are trailed along Highway 14A.

Currently, the WGFD is managing this population to remain in the core Devils Canyon area, and is combining hunting, translocations, and other means to reduce the potential for individuals straying out of Devils Canyon into potential contact areas (Easterly 2011). In 2009, a dozen bighorn sheep that were known to wander south between Cottonwood Canyon and Highway 14A, along with a few bighorn sheep just north of this area, were captured and translocated to a release site approximately 300 miles away in the Seminoe Mountains near Rawlins, Wyoming. The areas south of Cottonwood Creek and 14A is used as a “driveway” for approximately 5,400 domestic sheep each year, as they move on and/or off summer pasture in the Bighorn Mountains. This number is the mature sheep permitted for two permittees, and includes 4 separate bands. The number authorized annually may be less.

The known herd locations and movements are displayed in Appendix E. These locations show a few instances where bighorn sheep have moved onto the Forest temporarily, only to return to the Devils Canyon area. Easterly (2009) reported that 15 of 33 radio-collared bighorn sheep from the Devils Canyon herd travelled onto the Bighorn NF during the 2004 -2008 study. The Bighorn NF represented less than 3% of all their monitored locations during this time period, therefore, Easterly (2009) proposed that habitats on the Bighorn NF are not critical to this population of bighorn sheep. Most all locations on the Bighorn NF occurred within the first year of the Devils Canyon herd transplant, when bighorn sheep may have been exploring their new environment (Easterly 2009). It is principally considered that the presence of forested areas along the northern portion of the Forest adjacent to the Devils Canyon area limit the expansion of bighorn sheep onto the Forest.

Bighorn Canyon National Recreation Area Herd

The Bighorn Canyon National Recreation Area (Bighorn Canyon NRA) consists of approximately 68,000 acres lying between the Pryor and Bighorn mountain ranges along the Montana-Wyoming boundary. The Bighorn Canyon NRA was established by an act of Congress on October 15, 1966, following the construction of the Yellowtail Dam by the Bureau of Reclamation. The canyon offers a diversified landscape of forest, mountains, upland prairie, deep canyons, broad valleys, high desert, lake and wetlands. Since the creation of the Bighorn Canyon NRA, people have been able to find tranquil settings to better explore recreation, nature, wildlife, and history. Wildlife in Bighorn Canyon NRA includes bighorn sheep, wild horses, coyotes, mule deer, snakes, small mammals, mountain lions, bears, and more than 200 bird species. The 39,000-acre Pryor Mountain Wild Horse Range, about one-fifth of which lies within Bighorn Canyon NRA, provides habitat for both the sheep and for approximately 160 (feral) horses, is managed by the BLM.

The bighorn sheep populations that compose the Bighorn Canyon NRA herd began following sheep transplants into the Bighorn Mountains in 1973. Reportedly, some of these bighorn sheep crossed the ice and by 1979, one mature ram and three ewes were living on the west side of Bighorn Canyon. In 1993, a bighorn sheep population of 210 was reported. By 2000, the population had dropped to between 85 -119 bighorn sheep (NPS 2010). Radio-collar telemetry movement data collected from the Bighorn Canyon NRA herd from 1998 – 2001 displays some direct overlap with the Devils Canyon herd (Pickett, pers. comm.).

WGFD has documented movement and connectivity between the Devils Canyon and Bighorn Canyon NRA herd. Therefore, probable contact between these two bighorn sheep herds imparts potential risk of disease transmission. At this time, there are no known domestic sheep (ranch, farm or hobby flocks) in the East or West Pryor Mountains, within the core area used by the Bighorn NRA herd. The Yellowtail Wildlife Habitat Management Area (YWHMA) which lies within the Bighorn Canyon NRA has used domestic goats as a biological control of noxious weeds. The YWHMA is managed cooperatively through an agreement between the WGFD, NPS, BLM, and Bureau of Reclamation. Potential for contact between goats and bighorn sheep has precluded the use of domestic goats for noxious weed control on the north side of the Shoshone River where interaction between bighorn sheep and domestic sheep or goats is likely to occur. At this time, the goats have been moved south of the Shoshone River. Domestic goats being present and adjacent to bighorn sheep habitat have prevented a past bighorn sheep reintroduction into the Pryor Mountains by Montana Fish, Wildlife, and Parks (K. Hurley, pers. comm.) (Refer to maps in Appendix E). The NPS has killed domestic stray sheep within the Bighorn NRA in the past five years, though this action has been limited to a few individuals and not within the bighorn sheep herd area.

Following the recommendations of a U.S. Geological Survey team that studied the population dynamics and habitat use of 30 collared sheep during 2000 – 2003, habitat treatments such as burning and clearing of juniper have been carried out to improve otherwise suitable sheep habitat in the Bighorn Canyon NRA. Evidence of habitat improvement projects can be seen at Hillsboro, Barry's Island, and Mustang Flats. Today there is a viable and healthy population of between 150 to 200 bighorn sheep (NPS 2010), however, the opportunity for possible contact with the Devils Canyon herd or domestic sheep and goats denotes potential for contact (Refer to maps in Appendix E).

FACTORS CONSIDERED IN THE RISK ASSESSMENT

Potential for Contact Model

This risk assessment considers many factors including a model that evaluates “potential for contact” between domestic sheep and bighorn sheep. This modeling approach was primarily limited to potential contact (bighorn sheep and domestic sheep occurring at the same time on active domestic sheep allotments or trailing routes located on the Bighorn NF) on known adjacent domestic sheep flocks. Consequently, the risk assessment focuses on the Devils Canyon and Shell Canyon bighorn sheep herds.

Due to probable contacts between the Shell Canyon bighorn herd, domestic farm flock sheep located off-Forest, permitted domestic sheep on the Bighorn NF, and the possible interaction of domestic sheep with Bighorn Canyon NRA herd, the risk of potential interactions between the Shell Canyon, Devils Canyon, and the Bighorn Canyon NRA herd are also discussed, as comingling by these herds could impact the Devils Canyon herd.

The potential for contact model was derived from other known modeling approaches including the Pagosa Sheep Grazing Environmental Analysis (2010), Payette NF Draft EIS (USFS 2006)

and the Sierra Nevada model (Clifford et al, 2009). The Forest compiled the telemetry locations from each source population. Then, with each population, the Hawth's tools extension in ArcGIS was used to statistically delineate the 95% core home range area, and the 5% outer limit areas. These areas represent the distribution of known bighorn sheep locations from telemetry, and the likelihood that sheep will be in those areas, according to the frequency of telemetry locations associated with that area. While the recent Payette NF decision used a different modeling approach, as displayed in the Payette's Appendix L (USFS 2010), this approach was based on a much more robust data set (400 collars, thousands of points) than what was available to the Bighorn NF at this time, and the inclusion of a habitat based GIS modeling. In a personal communication with Payette NF modelers (Obrien pers. comm.), the Bighorn's approach may both over-estimate and under-estimate the confidence associated with the 5% outer limit area, and to a lesser extent the 95% core herd area. This could mean that polygons representing the home range take a different shape, although basically the same area represented is still used by the population. The 5% area includes both forays and limited seasonal habitat use from telemetry data. If either more data are obtained, or a better understanding of different modeling approaches are determined, a different GIS model could be applied at the five year (or sooner) evaluation of the Risk Assessment. Since the Bighorn NF risk ratings are not solely based on the GIS model, this potential for error is accounted for in the summary of risk ratings determinations and described in Appendices B,C, and D (Rationale / Justification for Risk Rating of Individual Allotments and Bighorn Sheep Herd by Interdisciplinary Team).

For the GIS model, nine layers were given weighted values and then analyzed using ArcGIS 9.3 to determine potential for contact between domestic sheep and bighorn sheep in and adjacent to the assessment area. The model uses the following GIS analysis layers and weighted values:

1. Bighorn sheep 5% outer limit (does not include the 95% core area). Weight of 2.
2. One half mile buffer around domestic sheep allotments. Weight of 2.
3. 1.5 mile buffer around domestic sheep on private lands near Shell, Wyoming. Weight of 2.
4. One half mile buffer around goats on private lands near Lovell, Wyoming. Weight of 2.
5. Bighorn sheep 95% core area. Weight of 3.
6. Domestic sheep allotments and stock trailing routes (½ mile wide) and trailing bed grounds (½ mile radius) + 1 ½ mile radius around recreation campsites on PRRD where domestic goats are a permitted use for packing. Weight of 3.
7. Domestic goats on Bighorn NF used for invasive or woody species control (2 pastures on NE portion of forest; 1 each in Sage Basin C&H and West Pass C&H). Weight of 3.
8. Domestic sheep on private lands. Weight of 3.
9. Domestic goats on private lands. Weight of 3.

Areas not described above were determined not to be a risk for potential contact in this model. Buffer distances for stock trailing, bed grounds, or from allotment boundaries were determined from observations conducted by professional Rangeland Management Specialists very familiar with the project area and domestic sheep trailing, herding, bedding, and movement patterns.

These buffers were meant to capture possible straying by domestic sheep. Buffer distances around private sheep and goat locations were based on known movements (different pastures used) or possible straying of those animals. There were no BLM domestic sheep grazing allotments known to be stocked within 10 miles of the Forest boundary on the western side of the Forest, north of Highway 14 to the MT state line.

The model rates potential for contact in five categories: 2, 3, 4, 5, and 6. Figures 1 – 6 (Appendix E) illustrate results of the GIS mapping application and include additional descriptions of data considerations. The following contact values were calculated using the weighted overlays of GIS layers described above. Overlap in the following contact values is related to GIS layers in the model intersecting at any spatial location.

Contact Value of 6 - the following scenario occurs

- a. Overlap of bighorn sheep 95% core use areas and domestic sheep grazing inside S&G allotments or stock trailing routes.
Under this scenario, there is the most potential overlap between bighorn sheep and domestic sheep and therefore the potential for contact is greatest of any of the other scenarios.

Contact Value of 5 - one of the following four scenarios occur:

- a. Overlap of bighorn sheep 95% core use areas and domestic sheep grazing outside S&G allotments (within the half mile buffer
- b. Overlap of bighorn sheep 95% core use areas and buffer around domestic sheep on private lands
- c. Overlap of 5% bighorn sheep outer limit areas and inside S&G allotments or stock trailing routes; or
- d. Overlap of 5% bighorn sheep outer limit areas and domestic sheep on private lands

The following four scenarios could have occurred within the model but did not.

- e. The 5% bighorn sheep outer limit area overlaps with domestic goats on private lands
- f. The 5% bighorn sheep outer limit area overlaps with domestic goats used for invasive or woody species control
- g. The 5% bighorn sheep outer limit area overlaps with the pack goat use area; or
- h. The bighorn sheep 95% core use area overlaps buffer around domestic goats on private lands

Under the above scenarios (a, b, c and d), there is potential for overlap between bighorns and domestics inside or outside Forest S&G allotments. Domestic sheep will spend much of their time in the primary range within the allotments and trailing occurs a minimum of two times (on and off), and thus the potential for contact with bighorn sheep is likely where these areas overlap with bighorn sheep 95% core use areas.

Contact Value of 4 - one of the following three scenarios occur

- a. Overlap of 5% bighorn sheep outer limit areas and buffer around domestic sheep allotments
- b. Overlap of 5% bighorn sheep outer limit areas and buffer around domestic sheep on private lands, or
- c. Overlap of 5% bighorn sheep outer limit areas and buffer around domestic goats on private lands

Under scenarios a, b, and c; there is potential for overlap between bighorn sheep and domestic sheep within the 5% bighorn sheep outer limit use areas. These scenarios are not as likely to occur, therefore, the potential for contact decreases. Domestic sheep are not permitted to graze outside sheep allotments; therefore, the only domestic sheep in buffered areas would be potential strays from the domestic sheep allotments. Domestic sheep trailing occurs inside and outside allotments; therefore, some potential for contact exists via domestic strays or via bighorn sheep dispersal. Young bighorn rams have been known to wander long distances (outside their 95% core use area) especially during the breeding season when there are domestic sheep within the surrounding areas or during exploratory excursions and may contact domestic sheep.

Contact Value of 3 - one of the following two scenarios occur

- a. Bighorn 95% core use areas only; or
- b. Inside domestic sheep allotments, stock trailing routes, or trailing bedgrounds, or domestic sheep or goats on private lands, or goats used for invasive/woody species control, or pack goats.

Under these scenarios, there is no overlap between domestic sheep and bighorn sheep.

Contact Value of 2 – one of the following two scenarios occur

- a. The 5% bighorn sheep outer limit areas only; or
- b. The buffer around domestic sheep allotments or the buffer around domestic sheep or goats on private lands.

Under these scenarios, there is no overlap between domestic sheep and bighorn sheep.

Model Assumptions and Identified Weaknesses:

The model does not identify suitable movement barriers or connected habitat that could provide potential travel corridors that could minimize contact between domestic sheep and bighorn sheep. The vegetation layer shown in Appendix E was used as a surrogate for this. While there are forested areas (physical barriers) in the northwest corner of the Forest that reduce the likelihood of bighorn sheep travelling onto the Forest further than they have been observed, there are also many open vegetation areas that could allow for bighorn sheep connectivity and travel. The forested areas and steeper slopes tend to limit stray domestic livestock dispersal, and in some cases allotments are fenced with woven wire (restricting sheep movement).

Other Factors Considered in the Risk Assessment:

1. Allotment livestock kind, stocking rates, or season of use adjustments made for the proposed action;
2. Professional opinions of WGFD, BLM, NPS, and Forest Service wildlife biologists;
3. Professional opinions of Forest Service resource specialists; and
4. Project design criteria and adaptive management strategies were not considered in the GIS model, but were considered in the Interdisciplinary Team's review process.
5. While there were no mileage buffers used around bighorn sheep herds to represent possible long range dispersal, the miles from domestic sheep allotments were considered in the rationale for risk ratings (Appendices B, C, and D). The reason these buffers were not applied were twofold: 1) the use of telemetry data from several years of observations on both the Shell and Devils Canyon herds indicate the current wandering potential of these sheep, and are captured within the 5% outer limit area used above in the model; 2) there have been flaws noted with the use of set mileage buffers in other projects, where bighorn sheep went beyond nine mile or other buffers.

Factors Not Considered in the Risk Assessment.

Bighorn sheep winter range areas for the Shell Canyon bighorn sheep herd have not been identified by WGFD and were not considered because domestic sheep grazing will not occur on any National Forest System grazing allotment during winter. During the winter or during rutting periods, the Shell Canyon bighorn sheep may wander near the domestic sheep farm flocks which exist on private lands adjacent to the Forest near Shell, WY.

The Devils Canyon bighorn sheep herd basically uses the same areas during spring, summer, fall, and winter. Domestic sheep are normally turned out on the Forest allotments no sooner than June 26. Domestic sheep are normally off the Forest allotments by September 30, which is well before the normal rutting time and potential movements of bighorn sheep rams.

RISK ASSESSMENT RESULTS

The risk results and accompanying tables are presented by alternative and divided into two sections; the Big 6 and outside the Big 6 (i.e. remaining collective sheep allotments on the Bighorn NF). The Risk Rating Results are presented for all Big 6 sheep allotments below in Table 4, under Alternative 1 (No Action), Alternative 2 (No Change – Current Management, and Alternative 3 (Proposed Action). Risk rating results for allotments outside the Big 6 project are shown in Table 6.

Big 6 Assessment Area

Big 6 - Alternative 1 (No Action)

Under this alternative, there will be no permitted grazing of domestic sheep in the Big 6 assessment area. All allotments (n = 43) analyzed under the Big 6 EIS would be closed to domestic livestock grazing. With no grazing, there will be no risk of contact between domestic

sheep and bighorn sheep due to sheep grazing activities on the Big 6 analysis area, authorized by the Bighorn NF.

Under this alternative, bighorn sheep will continue to occupy areas where they presently occur. Should populations increase, they may reoccupy historic ranges on the Bighorn Mountains. Under Alternative 1, the risk of potential contact between domestic and bighorn sheep exists on private lands adjacent to the Bighorn NF with domestic sheep grazing and on stock trailing routes located on lands adjacent to the Bighorn NF. Domestic sheep grazing occurs along the lower Shell Canyon area, above Shell, WY on private lands and stock trailing occurs adjacent to Forest lands along Shell Canyon, which provides risk of potential contact with the Shell Canyon bighorn sheep herd. This risk exists, even if domestic sheep were removed from the Bighorn NF. Bighorn sheep movements from individual members in the Shell Canyon herd present a risk of contact with the Devils Canyon herd. Currently, the WGFD considers it a high priority to protect the Devils Canyon herd from the Shell Canyon herd and actively pursues management decisions in an effort to gain more separation between these herds (K. Hurley, pers. comm.).

No grazing (Alternative 1) on the Bighorn NF within Big 6 would eliminate risk of contact for bighorn sheep on the Bighorn NF. However, risk of contact between domestic sheep and bighorn sheep remains, where domestic sheep farm flocks continue to exist on private lands adjacent to the Forest. Potential contact and intermixing between the Devils Canyon herd and the Bighorn Canyon NRA herd remains should either of these herds be exposed to disease. Some element of risk also exists between the domestic goats that are located near the Bighorn Canyon NRA herd. Pack goats also present a risk to all three bighorn sheep herds, however, goat-packing use is believed to remain very low, although hunting or recreation use of pack goats on the Forest has not been well documented.

Under Alternative 1, the potential exists for stray domestic sheep to wander into occupied bighorn sheep habitat, make contact with bighorn sheep, and transmit bacteria potentially leading to disease. Similarly, young bighorn sheep rams can wander long distances especially during the breeding season and are often the most likely to come into contact with domestic sheep and transmit disease back to the herd. Coordination with WGFD and BLM personnel regarding future NEPA domestic sheep analyses and decisions on the Bighorn NF will be fundamental in managing bighorn herds which may span administrative boundaries.

Several factors also exist that may affect bighorn sheep and limit population performance, stability, and viability within the Big 6 analysis area. These factors include: predation (from mountain lions, coyotes, black bears, domestic dogs, bobcats, golden eagles, and red foxes), interspecies competition (competitive interaction between bighorn sheep and other wild ungulates such as elk, deer, and moose for forage), natural events (lighting, avalanches and snow slides, falls, drowning, and forest fires), poaching, potential stress caused by human disturbance, and impacts from extreme winter conditions that limit access to forage or winter range. There may be some habitat degradation due to conifer encroachment associated with wildfire suppression.

Big 6 - Alternative 2 (No Change – Current Management)

Under Alternative 2 of the Big 6, livestock grazing would continue as prescribed under the current term grazing permits and associated AMPS or, in absence of such a plan, under the AOIs. Permitted domestic sheep numbers, seasons of use, and permitted AUMs would remain as presented in Table 2 of the Assessment (see Alternative Considered). Alternative 2 imparts potential risk of contact between domestic sheep and bighorn sheep due to domestic sheep grazing activities authorized by the Bighorn NF. Also, under Alternative 2, the cumulative effect for risk of potential contact exists, due to domestic sheep grazing and stock trailing routes off Forest system lands.

Under this alternative, bighorn sheep will continue to occupy areas where they presently occur. However, within the Big 6 analysis area, the assessment identified potential and/or minor overlap between bighorn sheep core use areas, domestic sheep grazing allotments, stock trailing routes on Forest but outside sheep allotments, between buffered stock trailing routes and buffered sheep allotments, and in areas used by bighorn sheep outside the 95% core use areas. Under Alternative 2, all risks of potential contact exist as described under Alternative 1 on adjacent non-Forest lands (cumulative effects). Therefore, due to these activities, the risk of contact between domestic sheep and bighorn sheep is present, both on and off the Forest.

Radio-collar movement data and visual sightings of bighorns have presented additional data which documents the risk of potential contact between domestic and bighorn sheep for the Shell Canyon and Devils Canyon herds. No overlap of bighorn sheep core use areas and domestic sheep grazing allotments occur on the Bighorn NF, except for the extreme north end of the Grouse Creek S&G allotment (Appendix E, Alternative 2 – Current Condition). Periodically, individual bighorn sheep from the Shell Canyon herd have been known to be present within the Hunt Mtn. stock trailing routes on the Bighorn NF (Appendix E).

Radio-collar movement data on Forest system lands represented less than 3% of all monitored locations, and most all locations on the Bighorn NF occurred within the first year of the Devils Canyon herd transplant when bighorn sheep may have been exploring their new environment. This was the most frequent period when bighorn sheep came onto the Forest.

Off-Forest cumulative risks for the Devils' Canyon herd include the herd mixing with domestic sheep being trailed near Cottonwood Creek, and/or mixing with members of the Shell Canyon herd or the Bighorn Canyon NRA herd (Figure 2). Therefore, due to these activities, the some level of risk of physical contact is present, both on and off the Forest, for all three sheep herds.

This Assessment identifies some level of risk under Alternative 2 (Current Management – No Change), which are not attributable to Forest Service actions, of contact between the Devils Canyon herd and the Bighorn Canyon NRA herd, due to their documented mixing and due to domestic sheep which are trailed through the Bighorn NF to other private, state, or federal lands. Potential risk also exists from domestic goat use on the YWHMA with the Bighorn Canyon NRA herd, which in turn, has been known to comeingle with the Devils Canyon herd. Similarly, there is the risk associated with the domestic goat herd on private land near the Bighorn Canyon NRA herd. The Bighorn Canyon NRA herd has never been observed near the boundary of the

Bighorn NF, however, potential risk to this herd exists from stock trailing off Forest system lands and their potential to mix with the Devils Canyon herd.

Big 6 - Alternative 3 (Proposed Action)

Under the Proposed Action of the Big 6, authorized livestock grazing would include all applicable standards and guidelines, as outlined in the Forest Plan (2005) and incorporate design criteria and adaptive management strategies with the intent of reducing potential risk of contact between domestic sheep and bighorn sheep. The design criteria and adaptive management strategies are depicted in detail under Alternatives Considered (Proposed Action) and include project wide design criteria, design criteria applicable to sheep allotments, design criteria applicable to domestic sheep trailing, and adaptive management actions. Even though Alternative 3 incorporates measures designed exclusively to reduce contact between bighorn and domestic sheep, variable levels of risk of contact exist. In numerous contact model scenarios, Alternative 3 reduces risk levels to a greater degree than Alternative 2, by incorporating the design criteria and adaptive management strategies. Under Alternatives 2 and 3, the cumulative effect for risk of potential contact remains, due to domestic sheep grazing and stock trailing routes off Forest system lands, and due to domestic sheep grazing on the Forest outside the Big 6 project.

Overall Risk Rating/Determination

Risk Ratings were determined by the Interdisciplinary Team. Risk Ratings were objective as possible, based upon the following: current science, GIS 9.3 modeling (See Appendix E), all relevant information available, and the resource specialists' experience and knowledge of the Bighorn NF, allotments, domestic sheep management, and bighorn sheep. Risk Ratings incorporate weighted GIS layer overlays and the Interdisciplinary Team's understanding of applicable design criteria, adaptive management strategies, temporal use of an area by sheep (bighorns or domestic), physical barriers, topography, bighorn sheep demographics, and spatial considerations (distance) of general routes and timing of bighorn sheep use of the area. These ratings are temporally bounded by the reasonable foreseeable future of 10-15 years.

Once all factors were considered, an overall risk determination was made ranking risk of contact (probability of bighorn sheep and domestic sheep within an active sheep allotment or trailing route). These ratings incorporate Forest Service permitted domestic sheep grazing activities only. Risk of contact was rated as none or no risk, low, moderate, high, or very high for each allotment (Table 4). Disease transmission however, was considered a correlate of contact, not an effect. Although disease transmission was discussed in this assessment, these ratings are not intended to be an estimate of disease transmission probability, only an estimate of relative level of risk for contact between domestic sheep/goats and bighorn sheep. Cumulative risks associated with non Forest Service (non-permitted) domestic sheep or goats are described in the text following the tables, but are not included in the risk ratings in the tables.

A rating of "none or no risk" indicates there will be no risk of contact between domestic sheep/goats and bighorn sheep or potential transmission of bacteria.

A rating of “very low risk or low risk” indicates the likelihood of contact between domestic sheep/goats and bighorn sheep and potential for disease transmission is anticipated to be low. The differences between low and very low were based upon distance factors.

A rating of “moderate risk” indicates there is a moderate likelihood that contact between domestic sheep/goats and bighorn sheep may occur at some point in the future, but effective separation may be achieved and/or maintained due to physical distance or management strategies. The risk of contact between domestic sheep and bighorn sheep, with the subsequent potential for transmission of bacteria, is anticipated to be less than for allotments in the “high risk” category.

A rating of “high risk” indicates the likelihood of contact between domestic sheep and bighorn sheep and potential for transmission of bacteria is anticipated to be high.

There are other factors that influence the potential for disease transmission to bighorn sheep across the assessment area that are not within the scope of the proposed action, and therefore not analyzed as part of the risk assessment. These factors include but are not limited to: , 1) recreational pack goat use (current use in the analysis area is very low or unknown); 2) stray domestic sheep entering from outside the analysis area, and 3) expansion of bighorn sheep herds into areas of permitted domestic sheep use outside of the analysis area.

A detailed Risk Rating rationale and justification for the Big 6 Allotments are attached in Appendix B.

Table 4. Risk rating for Big 6 allotments under alternative 1 (no action), alternative 2 (no change – current management, and alternative 3 (proposed action).

	Shell Canyon Herd Risk Rating			Devils Canyon Herd Risk Rating			BCNRA Herd – Risk Rating		
	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
Allotment -Beaver Creek Project Area (Medicine Wheel – Paintrock District)									
Antelope Ridge	None	Low	Low	None	Low	Low	None	Very Low	Very Low
Bear-Crystal Creek	None	Mod	Mod	None	Mod	Mod	None	Very Low	Very Low
Beaver Creek	None	Mod	Mod	None	Low	Low	None	Very Low	Very Low
Grouse Creek	None	High	None	None	Very Low	None	None	None	None
Hunt Mountain	None	High	High	None	Low	Low	None	Very Low	Very Low
Little Horn S&G	None	Low	Low	None	Low	Low	None	Very Low	Very Low
Red Canyon S&G	None	High	High	None	Low	Low	None	Very Low	Very Low
Whaley Creek	None	Mod	Mod	None	Mod	Mod	None	Very Low	Very Low

	Shell Canyon Herd Risk Rating			Devils Canyon Herd Risk Rating			BCNRA Herd – Risk Rating		
	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3	Alt 1	Alt 2	Alt 3
West Pass goat brush control	None	None	Very Low	None	None	Very Low	None	None	Very Low
Sage Basin goat brush/invasive spp control	None	None	Very Low	None	None	Very Low	None	None	Very Low
Trailing via Hwy 14A ₁	None	Low	Very Low	None	High	Mod	None	Low	Very Low
₁ Trailing routes looked at separately from individual allotments. Stock driveways are traditionally used to access multiple forest allotments by multiple permittees. This use is administratively controlled, and is of short duration (2-5 days).									
Allotment - Tensleep Project Area (Powder River Ranger District)									
Baby Wagon	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
Garnet	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
Leigh Creek	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
Hazelton	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
McClain Lake	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
Upper Meadows	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
Willow	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low
Gold Mine Trailing	None	Very Low	Very Low	None	Very Low	Very Low	None	Very Low	Very Low

As discussed under Alternative 1 (No Action), risk of contact is possible in areas directly adjacent to the Bighorn NF from domestic sheep on private land. The potential exists for stray domestic sheep to wander into occupied bighorn habitat, make contact with bighorns, and transmit bacteria potentially leading to disease. Similarly, young bighorn sheep rams can wander long distances especially during the breeding season and are often the most likely to come into contact with domestic sheep and transmit bacteria (potential disease) back to the herd. Alternative 1 would also include the risk of disease transmission from domestic sheep off the Forest, potentially affecting all three bighorn sheep herds.

The design criteria applicable under Alternative 3 were included in the risk ratings in the tables, however the adaptive management strategies are not reflected in these ratings. The risk ratings were developed from a conservative approach by the ID Team. Adaptive management strategies are addressed in Appendices B – D in the rationale listed there.

Monitoring Strategy Associated with Big 6 Alternative 3

Surveys to determine presence of bighorn sheep will be conducted by WGFD and/or Forest Service personnel in areas identified by the Risk Assessment as moderate or high risk, to reduce contact potential from domestic sheep to the Devils Canyon herd. Surveys will be performed prior to domestic sheep being trailed on or off the Bighorn NF along Highway 14A. Surveys will be conducted on active allotments during the grazing season on the Bear-Crystal and Whaley Creek Allotments. Surveys may entail several methods such as visual observations from canyon rims or surveillance points, vehicle, walking or riding horses along trailing routes or allotment boundaries, or monitoring flights (fixed-wing or helicopter). Each available method contains positive and negative aspects, as visibility of bighorn sheep is limited in draws, forested areas, or steep side canyons and fixed-wing or helicopter flights in canyons are both dangerous and expensive. Aerial surveys should also detect bighorn sheep south of Cottonwood Creek (located north of Highway 14A) and north of Horse Creek Canyon to promote and maintain separation between the Devils Canyon herd and Shell Creek herd. Monitoring is adaptive by design and where known deficiencies become apparent, they will be corrected.

If bighorn sheep are detected, as described in the design criteria and adaptive management strategies, immediate measures will be taken to reduce risk of potential contact between domestic sheep and bighorn sheep. Monitoring efforts will be coordinated with WGFD, BLM, Medicine Wheel – Paintrock Ranger District, Powder River Ranger District, and the Tongue Ranger District, due to bighorn sheep distribution across administrative boundaries, trailing of domestic sheep onto or through the Bighorn NF, and annual management of domestic sheep allotments. Additional population monitoring of the bighorn sheep may occur regardless of alternative by the WGFD and USFS. The WGFD, permittees, and Forest will annually review the monitoring strategy for coordination, effectiveness, population updates, habitat use changes, near-misses, and discuss conservation and multiple-use strategies. Additional surveys in each allotment may occur on an annual basis to determine effectiveness of the measures implemented to reduce contact potential. Monitoring will continue as long as domestic sheep allotments remain active and/or bighorn sheep occupy adjacent habitat.

Currently mapped moderate or high risk areas for the Devils Canyon bighorn sheep herd are displayed in Appendix E and include the following:

- Areas mapped near domestic sheep trailing;
- Areas mapped adjacent to active domestic sheep allotments

Strategies to monitor for the presence of Devils Canyon bighorn sheep or stray domestic sheep in moderate to high risk areas will include the following methods:

- On-the-ground or aerial survey of bighorn sheep habitat along high risk trailing routes and on or near active allotments associated with the Devils Canyon herd with moderate to high risk potential;
- Use of Bighorn NF employees or volunteers to monitor for the presence of bighorn sheep and straying domestic sheep throughout the grazing season;

- Increased funding for monitoring flights and radio-collaring of bighorn sheep will be sought after by the Bighorn NF;
- Rangeland Management Specialists will work with permittees to detect any bighorn sheep that may come close to domestic sheep. The Bighorn NF will provide any bighorn sheep identification and response protocol leaflets to permittees;
- Rangeland Management Specialists will strategize annually before and after the grazing season with the permittees to reduce the likelihood of stray domestic sheep;
- The Bighorn NF will inform the permittees immediately of any known stray domestic sheep, and vice versa;
- The Bighorn NF, permittees, and G&F will immediately share any information on bighorn sheep observed near domestic sheep.
- New information and new technology will be shared with the permittees, as it becomes available to assist them with bighorn sheep and stray domestic sheep detection;
- The Rangeland Management Specialists will work with permittees to focus monitoring and administrative efforts in areas of greatest risk - based upon risk assessment, observations, and radio telemetry data.
- The Bighorn NF will coordinate vegetative treatments with WGFD and BLM annually, to encourage or hold bighorn sheep in preferred habitat and monitor use for effectiveness.

Table 5. Monitoring Elements for Bighorn and Domestic Sheep

Monitoring Question	Indicator	Data Reliability	Measuring Frequency & Recommended Method	Report Period
Are Devils Canyon bighorn sheep present in identified risk areas	Observation, sighting, or telemetry	Low to High	Prior to and throughout the grazing season, via survey of identified areas	Annually
Are Devils Canyon bighorn sheep present on, or near active domestic sheep allotments or trailing routes	Presence of bighorn sheep and presence of domestic sheep	Low to Moderate	Prior to and throughout the grazing season, via survey of identified areas and active domestic sheep allotments & Highway 14A trailing routes	Annually
Is separation between Devils Canyon bighorn sheep and domestic sheep maintained	Presence of bighorn sheep and presence of domestic sheep	Low to Moderate	Prior to and throughout the grazing season, via surveys of all moderate to high risk active domestic sheep allotments & Highway 14A trailing routes	Annually

Are domestic sheep straying from permitted grazing allotments	Are domestic sheep in areas not permitted for grazing or not with band	Low to High	Throughout the grazing season by communicating with permittee, herder, and bands	Annually
Are trailing routes clear of stray domestic sheep	Presence of domestic sheep left behind or counts on/off Forest are off < or = than 1%	Low to Moderate	Prior to and following trailing by counts on/off Forest, walking or riding trailing routes to locate strays	Annually
Are Devils Canyon design criteria and adaptive management strategies effective in avoiding contact	Reports or observation of any contact	Low to High	Notification and changed management will occur immediately. Documented in Annual coordination meeting among WGFD & USFS & permittees	Annually

District staff will compile monitoring data and make recommendations to the District Rangers annually.

Remaining Sheep Allotments on the Bighorn NF (other than Big 6)

Assessment 1 – No Action

The No Action assessment is the same as “no domestic livestock grazing” and means that no domestic sheep and goat grazing would be authorized on the Bighorn NF.

Assessment 2 – Current Livestock Grazing Management

Under Assessment 2, livestock grazing on the Bighorn NF on allotments other than those described under the Big 6, would continue as prescribed under current term grazing permits and associated Allotment Management Plans (AMPs) or, in the absence of such a plan, under the Annual Operating Instructions (AOIs). Existing improvements would be maintained as assigned in term grazing permits and would be reconstructed as needed. New improvements not currently authorized under a NEPA decision would not be developed without further NEPA analysis and decision. Improvements on vacant allotments would be removed if no longer needed for wildlife or livestock grazing.

Table 6 describes current domestic sheep allotments with numbers of sheep, sheep class (mature sheep, ewe/lambs, or NA), season of use, and AUMs available.

Table 6. Summary of Bighorn NF Domestic Sheep Management Allotments (not included in the Big 6).

Allotment	Permitted # Sheep	Sheep Class	Permitted Season of Use	Permitted AUMs
Medicine Wheel / Paintrock District				

Allotment	Permitted # Sheep	Sheep Class	Permitted Season of Use	Permitted AUMs
Wallrock/Hidden Teepee	1500	Ewe/lamb	07/01-09/15	1139
Pole Creek	1200	Ewe/lamb	07/06-09/15	852
Paintrock C&H&S	N/A No sheep are permitted on the term permits. The 1991 EA states that sheep grazing may occur in 4 upper elevation pastures after 5 years rest. This has not occurred.	N/A	N/A	N/A allotment is permitted cattle
Medicine Lodge-Trapper Creek C&H&S&G	Variable numbers/season/kind permit allows cattle or sheep not to exceed 1012 cow months or 2215 sheep months	N/A	07/11-09/30	Not to exceed 2215 sheep months
Tongue District				
Lookout Mountain	Vacant	N/A	N/A	N/A
Fishhook/Fool Creek	1200	Ewe/lamb	7/6 – 9/18	888 AUMs
Bull / Woodrock	Variable	Ewe/lamb	Variable	Not to exceed 2,361 AUMs
Owen Creek	1450 320	Ewe/lamb Mature	7/4 – 9/5 7/4 – 9/5	915 AUMs 128 AUMs
Powder River District				
Crazy Woman	Vacant, but stocked annually	NA	Potentially 06/01 – 10/31	None
Elk Lake	Closed	NA	NA	None
Cloud Peak	Closed	NA	NA	None
Crazy Woman Stock Driveway	Stocked annually; trailing only	NA	Potentially	None

RISK ASSESSMENT RESULTS (Allotments on Bighorn NF not included in Big 6)

The risk results and accompanying tables are presented by alternative for all livestock allotments on the Bighorn NF which were not include in the Big 6 analysis. The Risk Rating Results are

presented by allotment in Table 7, under Assessment 1 (No Action) and Assessment 2 (No Change – Current Management).

Assessment 1 – No Domestic Sheep Grazing Outside Big Six

Under this assessment, there will be no trailing of livestock or permitted grazing of domestic sheep in the assessment area. All allotments (n = 10) analyzed would be closed to domestic sheep grazing. With no domestic sheep grazing, there will be no risk of contact between domestic sheep and bighorn sheep due to domestic sheep grazing activities authorized by the Bighorn NF.

Under this assessment, it was assumed that bighorn sheep would continue to occupy areas where they presently occur.

Even without domestic sheep grazing (Assessment 1) on the Bighorn NF, there would continue to be unquantifiable levels of risk of contact between the bighorn sheep herds and domestic sheep found on nearby private, state, or other federal lands due to stray domestic sheep or the potential wandering of bighorn sheep, especially during exploratory excursions or during rutting season. Some element of risk may exist between the domestic goats that could be used as recreational or hunting pack animals or for biological weed control adjacent to the Bighorn NF.

Assessment 2 – Current Sheep Grazing Outside Big 6

A detailed Risk Rating rational and justification for current sheep grazing not considered within the Big 6 Allotments are attached in Appendix C (Medicine Wheel / Paintrock District) and Appendix D (Tongue District). Assessment 2 Risk Ratings are presented below in Table 7.

Table 7. Risk Rating for all Domestic Sheep Allotments Not Considered within the Big 6 Analysis Under Assessment 1 (No Grazing) and Assessment 2 (No Change – Current Management).

	Shell Canyon Herd Risk Rating		Devils Canyon Herd Risk Rating		BCNRA Herd - Risk Rating	
	Assessment 1	Assessment 2	Assessment 1	Assessment 2	Assessment 1	Assessment 2
Allotment – Medicine Wheel / Paintrock District Area						
Wallrock/ Hidden Teepee	None	High	None	Low	None	Very Low
Pole Creek	None	Low	None	Low	None	Very Low
Med Lodge / Trapper	None	Low	None	Very Low	None	Very Low
Paint rock	None	Very Low	None	Very Low	None	Very Low
Trailing - Hunt Mt.	None	High	None	Low	None	Very Low
Allotment – Tongue District Area						
Fishhook /	None	Low	None	Low	None	Very Low

	Shell Canyon Herd Risk Rating		Devils Canyon Herd Risk Rating		BCNRA Herd - Risk Rating	
	Assessment 1	Assessment 2	Assessment 1	Assessment 2	Assessment 1	Assessment 2
Fool						
Owen	None	Mod	None	Very Low	None	Very Low
Bull / Woodrock	None	High	None	Very Low	None	Very Low
Allotment – Powder River District Area						
Crazy Woman S&G	None	Very Low	None	Very Low	None	Very Low
Crazy Woman Stock Driveway	None	Very Low	None	Very Low	None	Very Low
BHA Pack Goats	None	Very Low	None	Very Low	None	Very Low

Potential Scenarios Considered for Changed Conditions with the Abundance, Distribution, and Viability of the Shell Canyon and Devils Canyon Bighorn Sheep Herds

This section of the Risk Assessment describes a range of future potential Federal, State, and private sector management considerations, both on and off the Bighorn NF, which may impact abundance, distribution, and viability of the Shell Canyon and Devils Canyon bighorn sheep herds. Current conditions or management may not allow management for these options at this time, however, they are acknowledged to address opportunities to enhance bighorn sheep populations should future conditions allow. These scenarios investigate other possible opportunities for changed management under the NEPA “hard look” standard, though they currently do not represent management intent. They are also not necessarily “reasonably foreseeable future actions,” but are possibilities that warranted examining.

Shell Canyon Bighorn Sheep Herd

Scenario 1) Shell Canyon herd increases in abundance and distribution

This scenario would assume that bighorn sheep in Shell Canyon were managed towards becoming a viable herd, which is not currently the management intent. If the current Shell Canyon herd of approximately 10 – 15 bighorns increases in abundance and distribution, the scheduled re-evaluation of the Risk Assessment in five years would provide managers with information needed to adjust management as result of these changed conditions, or re-evaluation may occur earlier, as warranted. This process would re-examine Forest management decisions which affect bighorn sheep viability and

domestic sheep grazing. In past years, the Forest has examined opportunities to enhance bighorn sheep populations in the Shell Canyon area and outlined this process in the Shell Canyon Bighorn Sheep Reintroduction Proposal (1990) and the Shell Canyon Bighorn Sheep Cooperative Management Plan (1991). These documents provide direction on improving habitats on the Bighorn NF to potentially support 70 bighorn sheep on winter range in Shell Canyon on a year-long basis and assuming that bighorn sheep will migrate and utilize high elevation ranges during late spring, summer and early fall, a population of 200 animals, was possible. Some introduced populations may display fast population growth to fill available habitat, then exhibit population declines, followed by stabilization of the population or continued declines. The Shell Canyon bighorn sheep may be following a typical pattern of species expansion following reintroduction/transplant (T. Easterly, pers. comm.).

This scenario would require bighorn sheep to be favored over domestic sheep grazing, due to the fact that if the Shell Canyon herd increases in size and distribution and if the Forest provides for effective separation, most likely, domestic sheep grazing allotments or trailing routes in close proximity of occupied bighorn sheep habitat would be either changed, restricted, or closed. Occupied habitat is not defined in the Risk Assessment, as documenting bighorn sheep occupied habitat on the Bighorn NF has several challenges, such as increases or declines in bighorn sheep populations, bighorn sheep behavior, contradictions in reports of geographical distribution or sightings, and the availability of suitable habitat does not infer occupied habitat. Therefore, many factors influence the rate at which habitats are acquired and occupied and the likelihood of persistence once occupied. If the above scenario occurs, the Forest would work with the affected permittee(s) and follow FSM 2200 – Range Management Chapter 2230 – Grazing and Livestock Use Permit System, if changes in grazing permit(s), modification of permit(s), or cancellation of grazing permit(s) occur.

If the Shell Canyon herd increases, many of the design criteria and adaptive management strategies applied in these earlier documents could be reconsidered or expanded. These may include, but are not limited to: 1) working closely with WGFD to updated bighorn sheep management objectives ; 2) working with livestock permittees to change or restrict livestock use from domestic sheep and goats to cattle and horses on identified allotments; 3) treating additional areas with prescribed burning to open travel corridors through heavily timbered areas between bighorn sheep summer and winter range; 4) additional use of prescribed burning in sagebrush to improve bighorn sheep habitat; 5) develop additional water sources for bighorn sheep, and 6) install additional interpretive signs to inform public about bighorn sheep. One important factor not considered in the earlier Shell Canyon bighorn sheep plans is to provide for effective separation between bighorn sheep and domestic sheep. If the Shell Canyon herd increases in distribution on the Forest, within five years or as warranted, the Risk Assessment should be analyzed and adequate measures should be taken to provide for effective separation. The resulting analysis may suggest that management actions such as changing, restricting, or closing sheep grazing allotments may be warranted, where sufficient potential risk for disease transmission between bighorn sheep and domestic sheep exists. It is estimated that to

manage for a viable Shell Canyon bighorn sheep herd, the changed condition would present a high risk of contact between permitted domestic sheep on the Bighorn NF and the Shell Canyon bighorn sheep herd.

It should be noted, that if the Shell Canyon herd were to increase in abundance and distribution, the Forest would continue to work closely with WGFD and BLM to maintain effective separation between the Devils Canyon bighorn sheep herd and the Shell Canyon herd. These measures are essential, as the Shell Canyon bighorn sheep herd are currently considered “tainted” by WGFD, due to previous exposure with domestic sheep and therefore, may potentially infect the Devils Canyon herd with the disease bacteria.

This opportunity would likely be predicated on the changed condition described in Scenario 3 below.

Scenario 2) Shell Canyon herd ceases to exist

The Shell Canyon bighorn sheep population has declined considerably from the 111 sheep introduced between 1992 and 1994 and are not currently managed with objectives by WGFD. Definitive reasons for the bighorn sheep die-offs in the Shell Canyon area are unknown, however, wildlife biologists believe that the transplanted animals may not have been in good health to begin with or the herd has interacted with domestic sheep. Reports of individual Shell Canyon bighorn sheep co-mingling with domestic sheep on private lands adjacent to the Forest have occurred, but have not been verified by WGFD and Forest Service personnel. The potential for contact from Forest Service permitted domestic sheep exists, as reflected in Tables 4 and 7. Also potential for contact with domestic sheep off Forest is likely, as radio collared bighorn sheep from this herd have been documented approximately 1.4 miles from domestic sheep flocks located near Shell, WY.

If the Shell Canyon herd of approximately 10 – 15 individual bighorn sheep dies-out or are removed by WGFD personnel, the scheduled re-evaluation of the Risk Assessment in five years would provide managers with information needed to adjust management as result of this changed condition. If the herd no longer occupies the Shell Canyon area, either by natural die-off or WGFD management decisions, several potential scenarios exist. Three scenarios included are: 2A) The Devils Canyon herd may eventually expand their distribution and occupy habitats (BLM, private, and Forest) to the south of their present range; 2B) the WGFD may wish to reintroduce bighorn sheep into their historical range in the Shell Canyon area and establish a native herd that may connect over-time with the Devils Canyon herd and expand into areas historically occupied on the Forest; and 2C) domestic sheep producers temporarily or permanently re-occupy sheep grazing allotments in proximity to the areas vacated by the Shell Canyon bighorn sheep herd.

Under Scenario 2A, the Devils Canyon herd could be encouraged to expand southward and eastward across Highways 14A and 14, into areas previously occupied by the Shell Canyon herd. Under this scenario, the Forest would cooperate with the WGFD and BLM personnel to update bighorn sheep management objectives and ensure herd viability. The Forest would re-examine the Risk Assessment to ensure domestic sheep and bighorn sheep habitats are maintained at sufficient distances to avoid potential contact. It is estimated that to manage for an expanded Devils Canyon bighorn sheep herd, the changed condition would present a high risk of contact within the Shell Canyon area, between permitted domestic sheep on the Bighorn NF and the expanded Devils Canyon bighorn sheep herd.

Under Scenario 2B, the WGFD may wish to reintroduce a healthy population of bighorn sheep in the Shell Canyon area. Under this scenario, the Forest would re-examine the Risk Assessment and Forest management decisions which affect bighorn sheep viability and domestic sheep grazing. Most likely, the Forest would work with the WGFD and examine opportunities to enhance bighorn sheep populations in the Shell Canyon area, as were outlined in the Shell Canyon Bighorn Sheep Reintroduction Proposal (1990) and the Shell Canyon Bighorn Sheep Cooperative Management Plan (1991). However, the Forest would provide for effective separation, which was not closely examined in the above documents, as the science of separation and risk of contact/disease was not as developed at that time. This scenario would also necessitate a change by the WGFD to their current identification of the Bighorn NF as a “non-emphasis” management area for bighorn sheep.

Under Scenario 2C, the Forest would re-evaluate the Risk Assessment and examine opportunities for domestic sheep producers to temporarily or permanently graze sheep allotments where conflict between bighorn sheep and domestic sheep no longer exists.

Scenario 3) No Domestic Sheep on Private Lands Adjacent to Forest (Shell Canyon Herd)

This scenario removes the risk of contact associated with domestic sheep flocks intermingling or contacting the Shell Canyon bighorn sheep herd. Domestic sheep (farm flocks) are currently located approximately 1.4 miles from the Forest boundary, but may be grazed even closer to the Forest. Individual Shell Canyon bighorn sheep have been reported co-mingling with domestic sheep (Shell area domestic flocks) adjacent to the Bighorn NF boundary. In addition to the reported contacts above, radio-collar data collected from Shell Canyon bighorn sheep is consistent with those observations, revealing that collared bighorn sheep have been within ½ mile of these privately owned off-Forest domestic sheep. The domestic sheep have been in the Shell, WY area prior to the bighorn sheep reintroduction efforts, and are not associated with any domestic sheep permitted on the Forest. The Risk Assessment would be re-examined in five years or earlier, as warranted, if domestic sheep on private lands adjacent to the Forest have been removed and such conditions warrant re-assessment to benefit bighorn sheep on the Bighorn NF. Currently, these domestic sheep most likely present a higher risk to disease

transmission to bighorn sheep in Shell Canyon due to their year round presence, bighorn sheep movements during the winter months, and due to rutting behavior of bighorn rams. However, if they were to be removed, this may necessitate the Forest taking a closer look at domestic sheep allotments in or near Shell Canyon, some of which were not included in the Big 6 NEPA analysis, as the Forest would then have sole responsibility for potential disease transmission to bighorn sheep via domestic sheep grazing.

If in the future, the WGFD and Forest Service decides to augment or reintroduce bighorn sheep into the Shell Canyon area, adjacent privately owned domestic sheep are a concern. At this time, WGFD personnel do not have plans to supplement the Shell Canyon herd, as this small herd is believed to have been exposed to domestic sheep. Therefore, unless the Shell Canyon herd is removed or experiences a complete die-off, it is not expected that actions will be taken by WGFD to encourage the removal of those privately owned domestic sheep which currently reside adjacent to the Forest and the Shell Canyon bighorn sheep herd. However, if domestic sheep are removed from the Forest and if the Shell Canyon bighorn sheep are removed, strategies to remove or isolate the local domestic sheep farm flock would be beneficial to bighorn sheep restoration efforts into historical use areas, both on and off the Bighorn NF. This may necessitate a change in the WGFD's current identification of the Bighorn NF as a "non-emphasis" area for bighorn sheep.

Scenario 4) No Domestic Sheep Grazing on Bighorn NF

This scenario is described in detail under the No Action Alternative and means that domestic livestock grazing would not be authorized on the Bighorn NF. Therefore, under this scenario, no domestic sheep grazing would occur on the Forest. The effects of this action are discussed earlier in this Risk Assessment and further disclosed in Chapter 3 of the FEIS.

Under this scenario, potential risks to the Shell Canyon herd remain. The risk of contact to the Shell Canyon herd from domestic sheep adjacent to the Bighorn NF, remains as described above. Also, the WGFD would not likely allow Shell Canyon bighorn sheep to expand northward toward the Devils Canyon herd. Currently, WGFD wildlife managers would remove individual Shell Canyon bighorn sheep that are probable to contact Devils Canyon bighorns, in an effort to ensure potential disease bacteria are not transmitted from wild sheep to wild sheep. Overall, it is estimated, that there is a high risk of contact between domestic sheep located on private lands and the Shell Canyon bighorn sheep herd, and a moderate risk of contact between Shell Canyon and Devils Canyon bighorn sheep herds.

Since its peak in 1942, the domestic sheep industry has declined approximately 85% in sheep numbers (Wildl. Cons. Soc. 2006). Permitted domestic sheep numbers on the Bighorn NF have dropped during the past 20 years. Within the foreseeable future and this planning period (10-15 years), it is unknown if permitted domestic sheep numbers on the Forest will be maintained or decrease.

Devils Canyon Bighorn Sheep Herd

Scenario 1) Devils Canyon herd increases in abundance and distribution

If the current population of approximately 130 – 160 bighorn sheep (WGFD 2009) which occupy the Devils Canyon area increase in abundance and distribution, the scheduled re-evaluation of the Risk Assessment in five years would provide managers a chance to adjust management as result of this changed condition. Re-evaluation of the Risk Assessment may occur earlier than five years, if warranted. The WGFD have set management objectives for approximately 200 bighorn sheep in this population, approximately within the current occupied habitat (Easterly 2011). Therefore, it is assumed, if the Devils Canyon population increases above this population objective, the distribution of these bighorn sheep could expand across adjacent private, BLM, and Forest Service lands, including south of Highway 14A.

This scenario would most likely necessitate the WGFD and USFS to re-evaluate the bighorn sheep population objectives and the Forest re-examine management decisions that may affect the biological and environmental processes which influence bighorn sheep viability. This process would entail re-assessment of design criteria and adaptive strategies, as they apply to domestic sheep allotments or trailing on the Bighorn NF in proximity to occupied bighorn sheep habitat. It is estimated that to manage for an expanded Devils Canyon bighorn sheep herd, the changed condition would present a moderate to high risk of contact between permitted domestic sheep on the Bighorn NF and the Devils Canyon bighorn sheep herd.

Currently, WGFD has three years of bighorn sheep classification data and plan to continue survey flights for a minimum of three years. In past years, WGFD has not conducted regular, systematic classification surveys of the Devils Canyon bighorn sheep by WGFD, as classifying bighorn sheep during trend survey flights has been difficult. Counting bighorns from the ground is also difficult due to the amount of hiding cover (canyons) available and difficulty accessing the area. The last bighorn sheep survey occurred in December 2010 with approximately 164 bighorns counted, however, a small portion these sheep may have been double counted (T. Easterly, pers. comm.). Therefore, if in the future, the Devils Canyon herd increase their occurrence on the Bighorn NF (radio-collar movement data revealed these bighorns currently spend approximately 3% of their time on the Forest) (Easterly 2009), it is expected the Forest would re-assess and intensify collaborative efforts with our WGFD and BLM partners regarding bighorn sheep management issues.

If new information validates the expansion of the Devils Canyon bighorn sheep into new areas on the Forest relative to domestic sheep grazing activities, the WGFD and USFS may need to reassess bighorn sheep management objectives and the non-emphasis status of the Bighorn NF with the WY Domestic and Wild Sheep Working Group. Should the management emphasis change, this could also entail a Forest Plan amendment to address changed priorities, objectives, and resource allocation. An expanded Devils Canyon

bighorn sheep herd may involve allotments outside the Big 6 project area, where the design criteria and adaptive strategies have not been applied.

Adopting this scenario as management direction would entail bighorn sheep to be favored over domestic sheep grazing, due to the fact that if the Devils Canyon herd increases in size and distribution and if the Forest provides for effective separation, most likely, domestic sheep grazing allotments in proximity to occupied bighorn sheep habitat would be changed, restricted, or closed. If this scenario occurs, the Forest will work with the affected permittee(s) and follow FSM 2200 – Range Management Chapter 2230 – Grazing and Livestock Use Permit System, if changes in grazing permit(s), modification of permit(s), or cancellation of grazing permit(s) occur.

Also, if bighorn sheep expand southward along the Highway 14A corridor, additional measures to ensure separation may be warranted, such as prohibiting trailing of domestic sheep along this route and requiring trucking of domestic sheep, both on and off the Forest. However, if bighorns expand eastward and northward into the Sheep Mountain area, the potential for risk of contact decreases, as the distance from domestic sheep allotments increases.

If the Devils Canyon bighorn sheep population increases on the Bighorn NF, it is expected the Forest, BLM, and WGFD would cooperatively examine opportunities to enhance bighorn sheep populations on the Forest, similarly, as was accomplished and outlined in the Shell Canyon Bighorn Sheep Reintroduction Proposal (1990) and the Shell Canyon Bighorn Sheep Cooperative Management Plan (1991). If the Devils Canyon herd increases, many of the strategies applied in the above documents could be reconsidered or expanded. These may include, but are not limited to: 1) working closely with WGFD and BLM on an updated bighorn sheep management plan; 2) working with livestock permittees to change or restrict livestock use from sheep and goats to cattle and horses on identified allotments; 3) treating additional areas with prescribed burning to open travel corridors through heavily timbered areas between bighorn sheep summer and winter range; 4) additional use of prescribed burning in sagebrush to improve bighorn sheep habitat; 5) develop additional water sources for bighorns, and 6) install additional interpretive signs to inform public about bighorn sheep. The management plans could also provide for effective separation between bighorns and domestic sheep.

At this time, it should be noted, that if the Devils Canyon herd were to expand in distribution, dialog would continue between the Bighorn NF, WGFD, and BLM to maintain effective separation between the Devils Canyon herd and the Shell Canyon herd using the communication channels that have already been established. During February 2011, the BLM, WGFD, and Bighorn NF wildlife and fire management personnel met to discuss collaborative vegetative treatment strategies on BLM and Bighorn NF lands within or adjacent to the Devils Canyon bighorn sheep use areas. The intent of these meetings was to discuss cooperative vegetative management plans intended to “hold” or “move” bighorn sheep within defined areas, and thus, provide for greater probability of effective separation. Other potential bighorn sheep habitat areas which lie between the

Devils Canyon herd and Shell Canyon herd were identified as non-treatment areas, therefore, also reducing the potential of contact.

Scenario 2) Devils Canyon herd ceases to exist

The Devils Canyon bighorn sheep population is not expected to decline due to the existing viable population of approximately 160 animals. However, if a pneumonia outbreak occurs, the results are often mortality to many or most individuals within the herd. All age classes of bighorn sheep are typically affected. In addition to high mortality of all age classes during the pneumonia outbreak, lamb survival and thus recruitment typically remains depressed for 2-5 years, or more following the epizootic. Because of these impacts on both survival and recruitment, pneumonia outbreaks can have significant long-term impacts on bighorn sheep populations (Singer et al. 2001). An additional concern is radio-collar data indicates an overlap of occupied habitat used by the Devils Canyon herd and the Bighorn Canyon NRA herd, therefore, disease transmission to either herd, represents a high risk of disease transmission to both herds.

Herd decline has periodically been observed in the Devils Canyon population since the introduction in 1973. The original introduction consisted of 39 animals and by 2003 (thirty years later) had not increased in population size, with approximately 30 - 50 sheep remaining (Easterly 2009). This herd received an augmentation of 40 additional bighorns from 2004 – 2006 by WGFD. These sheep were selected from non-migratory (in elevation) bighorn sheep sources that would more likely remain within the Devils Canyon area, and not migrate onto private lands or the Bighorn NF (K. Hurley, pers. comm.). WGFD had hoped that introducing sheep from xeric, canyon habitats much like the Devils Canyon area would improve reproductive and survival rates. This latest effort appears successful and WGFD managers have a long-term herd objective of about 200 sheep (K. Hurley, pers. comm.). Although the Devils Canyon herd appears stable or increasing, managers are conscious of the nearby Shell Canyon bighorn sheep reintroduction efforts of 111 animals during the mid-1990s, which has steadily plummeted to the current population of 10 – 15 animals.

As documented in the Risk Assessment and relevant scientific literature, without immediate removal of domestic sheep from occupied bighorn sheep habitat, bighorn sheep within that habitat are likely at risk of contact and disease transmission. The Devils Canyon bighorn sheep have periodically occupied habitat contiguous or near the domestic sheep driveway along Highway 14A. Consistent with the bighorn sheep literature, bighorn sheep in Devils Canyon are capable of long-distance dispersal (mostly rams) outside of core herd home ranges. This life history trait can put bighorn sheep at risk of contact with domestic sheep, particularly when suitable habitats are well connected and overlap with domestic sheep use areas (Gross et al. 2000; Singer et al. 2000).

If the Devils Canyon herd of approximately 160 bighorn sheep dies-out, the WGFD, BLM, and Forest Service would likely re-examine the probable events or actions responsible for the die-off. The Forest Service would re-evaluate the Risk Assessment.

If the herd no longer occupies the Devils Canyon area, either by natural die-off or WGFD management decisions, such as removing probable disease exposed animals, but surviving individual bighorns persist, several potential scenarios exist. Three scenarios included are: 2A) The Bighorn Canyon NRA herd may eventually expand their distribution and occupy habitats (BLM and Forest) to the south and east of their present range; 2B) If the potential threats from domestic sheep are removed, the WGFD may wish to reintroduce bighorn sheep into their historical range in the Devils Canyon area and establish a native herd that may connect over-time with the Bighorn Canyon NRA herd and expand into areas historically occupied on the Forest; and 2C) bighorn sheep die-offs continue and domestic sheep producers temporarily or permanently re-occupy sheep grazing allotments in areas vacated by the Devils Canyon bighorn sheep herd or resume trailing on and off the Forest along Highway 14A.

Under Scenario 2(A), the Bighorn Canyon NRA herd may expand southward into areas previously occupied by the Devils Canyon herd. Under this scenario, the Forest would cooperate with the WGFD, NP, and BLM personnel to update bighorn sheep management plans and ensure herd viability. The Forest would re-examine the Risk Assessment to ensure domestic sheep and bighorn sheep habitats are maintained at sufficient distances to avoid contact.

Under Scenario 2(B), the WGFD may wish to reintroduce a healthy population of bighorn sheep in Devils Canyon area. Under this scenario, the Forest would re-examine the Risk Assessment and Forest management decisions which affect bighorn sheep viability and domestic sheep grazing. Most likely, the Forest would work with the WGFD and BLM to examine opportunities to enhance bighorn sheep populations in the Devils Canyon area, such as those outlined in the Shell Canyon Bighorn Sheep Reintroduction Proposal (1990) and the Shell Canyon Bighorn Sheep Cooperative Management Plan (1991). However, the Forest would provide for effective separation, which was not closely examined in the above documents.

Under Scenario 2(C), the Forest would re-evaluate the Risk Assessment and examine opportunities for domestic sheep producers to temporarily or permanently graze sheep allotments where conflict between bighorn sheep and domestic sheep no longer exists, due to unforeseen consequences (total bighorn sheep die-offs, WGFD has no plans to augment or reintroduce, adjacent farm flocks increase, etc.).

Scenario 3) No Domestic Sheep or goats on Private Lands Adjacent to Forest (Devils Canyon Herd or Bighorn Canyon NRA Herd)

This scenario removes the potential risk of contact with domestic farm flocks, goats, or trailing sheep intermingling or contacting the Devils Canyon bighorn sheep herd. The Risk Assessment did not identify any domestic sheep or goats on private lands which may potentially affect the Devils Canyon herd under their current known distribution.

The Yellowtail Wildlife Habitat Management Area (YWHMA) which lies within the Bighorn Canyon NRA is currently using domestic goats as a biological control of noxious weeds. The YWHMA is managed by the WGFD through an agreement with the NPS, BLM, and Bureau of Reclamation. Potential for physical contact between goats and the Devils Canyon bighorn herd was identified and the goats have been moved south of the Bighorn River, therefore, this action is believed to have eliminated the threat of contact.

Individual members (up to a dozen) of the Devils Canyon herd have been observed along Cottonwood Creek near the Highway 14A domestic stock driveway, which suggests potential for contact. The WGFD has designated Cottonwood Canyon as the southernmost area the Devils Canyon bighorn sheep herd will be allowed, which will deter potential comingling with domestic sheep/goats. The WGFD's objective is to maintain the Devils Canyon bighorn sheep population at viable levels, but vigorously make certain dispersal is low.

Domestic sheep (farm flock) on private lands are located adjacent to the Bighorn Canyon NRA herd (see map, Appendix E) and consequently, potential exists for interaction and transmission of disease from domestic sheep to the Bighorn Canyon NRA. Therefore, potential also exists for the Bighorn Canyon NRA herd to transmit disease to the Devils Canyon herd. This is due to overlap of occupied habitat between the Bighorn Canyon NRA herd and Devils Canyon herd (Appendix E).

In addition, should the Devils Canyon herd expand southward, there is a moderate risk of contact with domestic sheep located on private lands, near Shell, WY. This scenario would assume that risk is removed.

The Risk Assessment identified domestic sheep trailing along Highway 14A, as the only high risk area on Forest lands for the Devils Canyon sheep herd. This trailing risk also occurs along Highway 14A on adjacent BLM lands, as domestic sheep trailing onto the Forest must pass through BLM lands. These risks would continue under this scenario since domestic grazing would still be occurring on the Bighorn NF.

If in the future, domestic sheep are removed from the Forest, the stock driveway along Highway 14A will not be used for domestic sheep trailing. Future bighorn sheep restoration efforts should entail working with adjacent private land owners to identify and hopefully, cooperatively remove any new domestic farm flocks of sheep or goats identified within potential contact areas of bighorn sheep.

Scenario 4) No Domestic Sheep Grazing on Bighorn NF

This scenario is described in detail under the No Action Alternative and means that domestic livestock grazing would not be authorized on the Bighorn NF. Therefore, under this scenario, no domestic sheep grazing would occur on the Forest. The effects of this

action are discussed earlier in this Risk Assessment and further disclosed in Chapter 3 of the EIS.

Under this scenario, there would be few potential risks to the Devils Canyon herd. However, the risk of contact to the Devils Canyon herd from domestic sheep or goats on lands adjacent to the Bighorn NF could remain, if the Devils Canyon herd increases in abundance and distribution, and therefore increase the probability of random long-distance dispersal (mostly rams) outside of core herd home ranges.

ACKNOWLEDGEMENTS

Portions of this plan were liberally patterned after the Risk Assessment for the Pagosa Sheep Grazing Environmental Analysis (2010) and the Final Supplemental Environmental Impact Statement and Forest Plan Amendment Identifying Suitable Rangeland for Domestic Sheep and Goat Grazing to Maintain Habitat for Viable Bighorn Sheep Populations (2010).

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Reviewed by: Tom Easterly and Kevin Hurley (WGFD) on 12/10/2010, of review/comment via conference call on 12/10/2010, and on 2/28/2011 by Tom Easterly (WGFD).

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APPENDIX A: DISEASE TRANSMISSION RISK REDUCTION - FACTORS CONSIDERED

Alternative/design criteria and adaptive management strategies were considered for the Big 6 project and forest-wide contexts. This is for both the Shell Canyon (SC) and Devils Canyon (DC) bighorn sheep herds. Adaptive management strategies that would have implications on allotments or activities outside those considered in the Big 6 would require additional NEPA analysis prior to implementing. Design Criteria and Adaptive Management Strategies listed would be implemented with selection of Alternative 3 in the Big 6. Adaptive management strategies listed would be implemented progressively based on need determined by both Wyoming Game and Fish Department (WGFD) and USFS, and would be triggered with one or more contacts between domestic sheep and bighorns. Most of the following actions considered either came from the WAFWA (2010) recommendations (see last part of appendix) or from the Wyoming Statewide Bighorn/Domestic Working Group recommendations (WGFD 2004).

Risk Factor	Potential Actions	Discussion	Disposition
Contact on non-NFS land	Fence along NFS boundary.	The cost to build and maintain an effective fence along the extremely rugged topography on the Forest boundary in the Shell Canyon (SC) (to keep them on the forest) and Devils Canyon (DC) (to keep them off the forest) areas is prohibitive, and would not guarantee sheep separation due to likely maintenance faults. Neither electric nor woven wire fence would be feasible year round in these areas.	Not adopted as design criteria or adaptive management strategy.
	Consult with private landowners to adjust their practices – change livestock class, create additional fencing.	Given the custom and culture of north-central Wyoming (see Forest Plan social/economic analysis), even the suggestion of Federal imposition on private land is delicate, at best. Given that the WGFD has designated the Bighorn NF as a non-emphasis area, there is little incentive or logic for private landowners to change practices to aid Bighorn NF bighorn sheep. Continued interaction among members of the statewide working group provides emphasis of this concern among wool growers and other private landowners. The USFS cannot purchase or affect private land domestic sheep grazing, however other	The Forest and WGFD will continue to share information on the benefits of bighorn sheep and domestic sheep separation with people. No additional design criteria or adaptive management strategy added.

Risk Factor	Potential Actions	Discussion	Disposition
		private organizations have worked cooperatively with private landowners in the past. Options could include relocating or double fencing private land flocks	
Contact on NFS land from domestic sheep allotments	Change Grouse Creek S&G (Sheep and Goat) to C&H (Cattle and Horse)	In effect, this was done when the last domestic sheep grazed in 1990. The conversion in name would formally occur in this decision. Analysis for livestock kind conversion included in FEIS.	Included in Alternative 3 FEIS.
	Change Hunt Mountain S&G and Red Canyon S&G to forage reserves for sheep and goat only (not cattle).	These allotments have not been grazed by sheep since the mid-1980's except for 1 pasture on Hunt Mountain S&G, immediately adjacent to other S&G allotments. It is likely that only this one pasture would be used due to the terrain and vegetation. Vacant allotments could be applied for and grazed, so this change limits overall potential grazing. There is a benefit of not being permanently assigned to a permittee, but not as much as if the allotments were retired. Terrain is not suited for cattle grazing. These allotments are in the vicinity of the SC herd locations, for which viability is not managed. Since there is an adjacent S&G allotment stocked, there would not likely be much spatial separation benefit achieved by closing this pasture/allotment.	Included in DEIS and FEIS Alternative 3.
	Close some or all of the domestic sheep allotments	There are many possible combinations of allotment closures. The most benefit to reducing the risk of contact is to close those nearest to known bighorn sheep locations. Antelope/Bear/Crystal allotments are nearer to known radio collared locations of bighorn sheep from DC.	The closure of allotments within the Big 6 to domestic sheep grazing will be included as an adaptive management strategy in FEIS alternative 3 as follows: Close domestic sheep allotments and cancel permits within the Big 6 project area, near Devils

Risk Factor	Potential Actions	Discussion	Disposition
		<p>WGFD has stated that Whaley S&G and Red Canyon S&G have more potential for contact with bighorn sheep from SC than from DC area.</p> <p>The closure of allotments within the Big 6 project would be included as an adaptive management strategy only where potential contact with the DC herd would be benefitted in conjunction with managing for the viability of the DC herd. <i>The trigger for closing allotments is the failure of other adaptive strategies.</i></p> <p>While closures of allotments (and thereby trailing) near SC herd may benefit that herd, this herd has likely been repeatedly exposed to domestic sheep, with this potential continuing on private lands adjacent to the Forest regardless of allotment closures. There is limited value to reducing the SC risk of comingling by this action.</p> <p>Other allotments outside the Big 6 project could also be considered for closure, however these would need to be under a separate NEPA analysis. It is not currently thought that within the next 10 years that the DC herd would expand onto the Forest to warrant closures outside the Big 6 project area to reduce the comingling potential.</p> <p>The likelihood of success of maintaining the viability of the Devils Canyon herd is good under Alternative 3 (based on GIS modeling plus these strategies/design criteria), but this action may be needed if these strategies fail to protect the herd.</p>	<p>Canyon bighorn sheep herd, if contact between bighorns and domestic sheep warrant it based on failure of other adaptive management strategies. Closure of domestic sheep allotments outside the Big 6 project area would require additional NEPA analysis.</p>
	RX burning proposed for the S&G allotments in	If additional timber is removed along the face country between	An additional design criteria was added to

Risk Factor	Potential Actions	Discussion	Disposition
	<p>Beaver Cr could attract bighorn sheep from SC and DC to interact. Plan and time any burns in close coordination with WGFD to reduce this potential. Consider timing those burns to avoid creating a corridor for bighorns to follow – avoid connecting burned areas over a short time period.</p>	<p>Hwys 14 and 14A, this could encourage SC bighorns to travel north, potentially interacting with DC herd. The proposed rx burning along the western Forest boundary was included in the project mostly in response to BLM proposed “fire use” and prescribed fire management areas, and FS “fire use” at the time of DEIS. However, a change in federal fire policy (BLM and USFS) has negated the need for NEPA to claim treatment acres associated with managing wildfires in this context (fire use). The FS would not likely propose any rx burns along the face country now, but if they were desired in the future, the Big 6 NEPA would allow for it. However, there is a strong need to coordinate any rx burning planned by FS or BLM with WGFD to ensure that the timing (allowing regrowth of timber as barrier for sheep) and size/extent of the burns are taken into consideration with this issue, and with past wildfires. Since wildfires in the face area are a likely occurrence (e.g. Bear Fire 2007), it would not be desirable to encourage/allow excessive lateral spread with those fires if possible. However, most fires on the face travel mostly uphill in response to topography and wind, so this may not be of much concern.</p>	<p>Alternative 3 for the FEIS to address this issue, as follows: For any fire management (prescribed or wildfire) actions along the western FS boundary north of Hwy 14, coordinate with WGFD and BLM to ensure that adequate vegetative structure remains to discourage bighorn sheep travel in this corridor. This is intended to minimize potential interaction between the Devils Canyon and Shell Canyon herds.</p>
	<p>Move domestic sheep near Devils Canyon herd to the vacant Willow, McClain Lake, Leigh Creek S&G allotments on PRRD</p>	<p>The FEIS shows that these allotments have regular authorized use from adjacent permitted allotments. Alternative 3 is being revised in the FEIS to assign specific allotments to term grazing permits as they have been used for the last several years, and are not vacant.</p>	<p>Alternative 3 revised between DEIS and FEIS to indicate these allotments will be permitted to existing authorized permittees.</p>

Risk Factor	Potential Actions	Discussion	Disposition
	Move domestic sheep near Devils Canyon herd to the vacant Elk Lake and Cloud Peak S&G allotments on PRRD	Wilderness policy is that if allotments were not permitted at the time of Wilderness designation, then they should not be restocked. Elk Lake and Cloud Peak allotments were last permitted in 1969, well before 1984 Wilderness designation. This is not a feasible option.	Not an implementable option, per FSM policy.
	Move domestic sheep near Devils Canyon herd to the Lookout S&G allotment on Tongue RD	See page 2-71 of the Tongue FEIS. In summary, it says the area has not been grazed since the 1980's because of a recommendation from the last permittee who tried to graze the allotment to no longer try to graze the area with sheep - rough terrain and difficulty in moving between suitable range, establishment of young trees in old clear cuts and difficulty of moving sheep wagons to suitable bed grounds. The allotment is not fenced and cattle from the adjacent allotment were utilizing the most accessible portion of the suitable acres. As a result, a portion of the area suitable for cattle grazing was included into the cattle allotment (to help relieve heavy stocking there) and the least accessible acres left vacant.	Not included in an alternative or adaptive management strategy.
	Move domestic sheep near Devils Canyon herd to vacant S&G allotments in future.	There may be vacant S&G allotments on the Forest in the future for which this action would be desirable if other adaptive strategies were failing to protect DC bighorns. This would be in conjunction with closing a S&G allotment near the DC herd, while still providing a permittee an opportunity to graze domestic sheep elsewhere. There were no known vacancies for which this could be considered at this time. No additional analysis	This was added to adaptive management strategy to FEIS alternative 3, as follows: Move permitted domestic sheep near Devils Canyon bighorn sheep herd to vacant S&G allotments on the Forest that may be identified in the future, if contact between bighorns and domestic sheep warrant it.

Risk Factor	Potential Actions	Discussion	Disposition
		would be necessary to transfer sheep between existing allotments, assuming that stocking rates match those previously permitted and covered by NEPA analysis. This recommendation is also cited in the WGFD statewide interaction group document.	
	Move domestic sheep near Devils Canyon herd to any C&H allotments that become vacant.	There are no currently vacant C&H allotments that could be analyzed to be included in this decision, with the exception of the Red Canyon C&H. Due to the terrain and vegetation, this allotment was not deemed suitable range for domestic sheep. There is a possibility that C&H allotments would become vacant in the future for which this option may apply if needed to benefit the DC herd at a later date. A supplemental analysis to this decision or separate NEPA would be required that is site specific to this type of conversion. The trigger point for using this option is if other adaptive management strategies did not benefit DC herd, and there was another allotment available that would not result in permit cancellation for a domestic sheep permittee.	This was added to adaptive management strategy to FEIS alternative 3 as follows: Move permitted domestic sheep near Devils Canyon bighorn sheep herd to vacant C&H allotments that may be identified in the future, if contact between bighorns and domestic sheep warrant it. Complete any additional NEPA analysis required.
	Require a full time herder for each band of sheep.	A full time herder would minimize straying domestic sheep and provide a warning of any potential bighorn sheep in the area. This also promotes appropriate vegetation utilization.	Included in DEIS & FEIS Alternative 3 - Design Criteria 19 – no changes.
	When bighorn sheep are in visible proximity of, or are known to come in contact with domestic sheep, the permittee or USFS personnel shall immediately notify the WGFD with the location and description of the	This measure allows for quick reaction to possible comingling interactions. WGFD policy is to lethally remove any bighorn sheep that have come into contact with domestic sheep.	This measure included as Design Criteria associated with Alternative 3, modified to clarify wording in FEIS.

Risk Factor	Potential Actions	Discussion	Disposition
	bighorn sheep.		
	Herders use SPOT GPS units and/or cell phones or satellite phones to notify permittee(s) who will notify the USFS or WGFD of contact for immediate management.	SPOT systems are not fool-proof in their communication ability, but would be much cheaper to implement than satellite phones, which also have potential to fail. Cell phones do not have reliable coverage on the entire Forest. The USFS has experience with all 3 systems on the Forest. Satellite phones are cost prohibitive. Several permittee(s) and herders within and adjacent to the Big 6 currently use cell phones reliably.	This use of SPOTS were added as an adaptive management strategy for Alternative 3 – FEIS as follows: Utilize SPOT GPS devices with domestic sheep herders to notify USFS or WGFD of potential bighorn/domestic sheep contact.
	Salt only sufficient amounts, so that surplus is not left behind after domestic sheep leave the area to minimize attraction to wildlife species	Salt can be an attractant to bighorn sheep if excess amounts are left. Minimizing the amount used and left behind will minimize potential for contact.	This was added as a design criteria to alternative 3 for the FEIS.
	The Forest Service and WGFD shall provide photos of bighorn sheep, with written information of the potential domestic/bighorn sheep contact issues, printed in both English and Spanish to permittees in their AOIs for distribution to their herders.	Many of the sheep herders are of other nationalities, and may or may not have ever seen even a picture of a bighorn sheep. In order to improve the effectiveness of the prompt notification of the location of bighorn sheep on the National Forest that are, or soon to be, in proximity of domestic sheep, the permittees proposed this potential action.	This was added as a design criteria to alternative 3 for the FEIS.
	The WGFD and Forest Service will cooperatively monitor the Devils Canyon bighorn sheep herd to detect expansion of the sheep herd and/or potential interaction with domestic sheep.	Radio collar data (Easterly 2009) was used to develop bighorn sheep distribution maps shown in the risk assessment. However, it is important to be aware of how that distribution may change in the future. The WGFD has already shown their intent to translocate bighorn sheep that spend time south of cottonwood canyon. This information will be used to minimize the potential for bighorn and domestic sheep interaction.	This was added as a design criteria to alternative 3 for the FEIS.

Risk Factor	Potential Actions	Discussion	Disposition
Contact from trailing domestic sheep to or from NFS land, or between allotments on NFS land.	For sheep being trailed onto/off the Forest along US Hwy 14A, a count of sheep will be taken immediately prior to entry on Forest, and a subsequent count taken immediately upon entry to the authorized grazing allotment. If sheep are trailed off the Forest, a count of sheep will be taken immediately prior to trailing from the allotment and a subsequent count will be taken immediately upon exit of the Forest. Counting locations will occur where it is conducive to obtaining the most accurate count. In addition, a count of any sheep added or removed during the season (such as weaning, incorporating bucks, etc) and known losses to predation, or other natural causes will also be reported at the end of the season to help determine if stray domestic sheep are left on the allotment/trailing route. These counts will provide the most accurate information, however it is understood that a small percentage difference in count (less than 1%) could occur due to unknown death losses or miscounting. Stray domestic sheep will be removed from potential contact areas.	Counting allows some measure of protection, especially if a group of sheep breaks off from the main band. However, counting several hundred to over 1,000 sheep is not an exact procedure, which is why the estimated error of 1% was deemed feasible, in conjunction with other factors listed.	Design criteria –in DEIS and FEIS, with no changes.
	The USFS will notify the WGFD of intended livestock trail on/trail off dates along the Hwy 14A trail. A field evaluation or monitoring flight of the potential contact area will	This measure can serve as an early warning/detection system for potential contact, although it is not foolproof. This would be implemented in advance of either holding pasture fences or trailing cancellation included	This measure was included as a design criteria associated with Alternative 3 – Design Criteria 25 in DEIS, and was modified with regard to the area for which this

Risk Factor	Potential Actions	Discussion	Disposition
	be conducted by WGFD and/or FS personnel within 10 days of the trailing. The USFS will consult with WGFD regarding if bighorns are present within the trailing area, prior to issuing permission to the permittee(s) for livestock trailing. If bighorn sheep are within the area, they will be hazed, or moved with other methods deemed appropriate by the WGFD, out of the area.	as adaptive management strategies.	applies for the FEIS.
	Construction of a temporary holding pasture fence along the Hwy 14A stock driveway (Antelope Ridge, Bear/Crystal, and Beaver Creek allotments) for domestic sheep to reduce wandering or potential contact.	As a precursor to trucking of sheep, the construction of fences at bed grounds for domestic sheep along the trailing routes may help reduce potential contact with bighorns. Wandering of domestics that may occur on bed grounds due to lack of herding at night could invite additional opportunity for contact with curious bighorns that a fence may reduce. This measure would only be applied on USFS land, unless other cooperators desire to similarly participate. This measure may be implemented if counting of livestock indicates many strays are left, or other potential contact with bighorns indicate it would be of benefit. There are only about 2 or 3 sites on the Forest used as bed grounds along this trailing route, with an additional 5 or 6 off Forest. The bed ground sites were mapped in approximation as part of the GIS modeling exercise.	This is an adaptive management strategy under FEIS alternative 3 as follows: Construct temporary holding facilities on NFS lands for bed grounds of domestic sheep trailing along Hwy 14A to reduce potential contact with bighorns. Encourage cooperators to similarly construct these facilities.
	Cancel trailing of domestic sheep through the headwaters of Shell Canyon and Hunt Mtn road to allotments on Tongue RD, or onto Forest through Whaley S&G.	This poses a risk to the bighorn sheep in SC, some of which have been shown to travel to the Shell Reservoir vicinity, crossing this trail and residing near the allotments they access.	This was not included as an adaptive management strategy with the Big 6. Implementation of this would likely require additional NEPA analysis as this trailing, except the

Risk Factor	Potential Actions	Discussion	Disposition
		<p>Domestic sheep are trailed at the end of the season off the Forest on this route, but are trucked onto the Forest at the beginning of the season. Trailing between allotments also occurs during the summer season. The bighorns in SC have most likely already been exposed to domestic sheep, and would likely continue to have risk off Forest on private land with domestic sheep. The remaining SC bighorns may have developed some resistance to disease currently, and there is likely some reproduction continuing.</p> <p>The larger concern with SC bighorns is potential interaction with the DC bighorn herd, introducing disease to them. As discussed in the Biological Evaluation, the Forest is not managing for viability of the SC herd as it has not existed since the formation of the Forest. Should the cancelling of trailing outside of Big 6 project area be considered, it would require further NEPA analysis. Trucking between allotments would not be feasible. There is also sheep grazing in some Tongue allotments through which the trailing occurs.</p>	<p>Whaley S&G, is not associated with allotments analyzed in the Big 6 project.</p>
	<p>Truck domestic sheep, instead of trailing along Hwy 14A. For those allotments associated with Big 6 project area.</p>	<p>Should one confirmed contact of domestic sheep with DC bighorns occur associated with domestic sheep trailing, the USFS would assess with WGFD if bighorns had wandered into the trailing route, or if strays from the trailing had occurred. If it is strays from trailing, trucking will be required. The WGFD has committed to keeping bighorns from establishing home ranges south of Cottonwood Canyon in the DC area.</p>	<p>This was added as an adaptive management strategy associated with Alternative 3 – FEIS as follows: Should one confirmed contact of domestic sheep with DC bighorns occur associated with domestic sheep trailing, the USFS would assess with WGFD if bighorns had wandered into the trailing route, or if strays from the trailing had</p>

Risk Factor	Potential Actions	Discussion	Disposition
		<p>If comingling associated with the trailing cannot be controlled, the USFS would require the permittee(s) to truck sheep onto and off of the Forest. This would be an adaptive management strategy utilized if the contact was not associated with bed grounds where a holding pasture fence could eliminate the potential contact, and where counting and other strategies failed to detect stray domestic sheep. GIS analysis indicates that this is the one closest threat to the Devils Canyon herd. Although it is uncertain when, if at all, future bighorn sheep wandering could occur into the trailing route, and whether or not domestic sheep would be there (timing) for potential contact. For this reason, cancellation of trailing was not recommended until further observation of the trailing and bighorn use patterns occur.</p>	<p>occurred. If it is strays from trailing, indicating a failure of other adaptive strategies, trucking can be required.</p>
	<p>Increase the number of guard dogs, use of bells, or marker sheep to assist herder in tracking potential for strays.</p>	<p>Permittees could choose to use any of these practices more than currently used if it will help in tracking the herd to reduce potential for strays. Permittees currently mark all mature sheep.</p>	<p>This was added as an adaptive management strategy associated with Alternative 3 – FEIS as follows:</p> <p>Permittees may increase the use of guard dogs, marker sheep, or other methods to assist in tracking domestic sheep bands to reduce strays where needed.</p>
	<p>Use additional water developments to increase separation where needed.</p>	<p>Water developments were constructed by WGFD and BLM for Devils Canyon herd off Forest. The Forest is not limited in water distribution that this measure would create further opportunities for separation. Additional water sources would not likely concentrate bighorns any more than they are, nor would water</p>	<p>This measure was not adopted as either adaptive strategy or design criteria.</p>

Risk Factor	Potential Actions	Discussion	Disposition
		developments help keep domestics further away, as both species primarily use natural water sources (creeks).	
Genetic issues with ~15 bighorns remaining in SC herd , and inter-actions with DC herd.	Supplement SC herd or remove SC herd	<p>111 bighorns were reintroduced in mid-1990's with ~ 15 remaining. Experience with other herds indicates this herd is likely to fail. If more bighorn sheep were added to this herd, either range or density would increase, both of which increases probability of contact with domestics. It is unknown if the remaining sheep would grow into a viable herd or not, or whether or not they have disease resistance from past exposure.</p> <p>The WGFD has classified the Bighorn NF as a non-emphasis area for bighorn sheep, and would likely not supplement or do anything to augment the SC population given risks of bacteria transmission. Neither would the SC herd be removed unless it attempted to join to the DC herd.</p>	This authority and responsibility is outside of the USFS jurisdiction, and no adaptive or other strategy was developed.
	Connect SC herd with DC herd for genetic variability	WGFD does not want interaction between the remaining, non-viable SC herd and the viable DC herd, since the SC herd is considered as exposed to disease.	Control actions on either population are outside the USFS jurisdiction.
	Continued monitoring of either DC or SC with telemetry collars	As this activity is expensive, it was not selected for design criteria. Should potential interaction activity increase and funding be available, the Forest and WGFD may cooperatively conduct this monitoring. The past monitoring of both herds was cooperatively done by the USFS and WGFD to result in data used for this analysis.	This monitoring action was added as an adaptive management strategy for Alternative 3 of the FEIS as follows: Cooperatively conduct telemetry monitoring of bighorn sheep to determine if there is expansion in bighorn sheep range, indicating a higher potential for possible contact with domestic sheep or interactions between the DC and SC

Risk Factor	Potential Actions	Discussion	Disposition
			herds.
Contact from domestic goats used for either weed control or packing.	Prohibition of domestic goat use near the DC herd to prevent potential disease transmission.	<p>Currently, there is one special use permit issued to an outfitter/guide in the Tensleep Canyon area for the use of domestic goats for recreational hunting/packing purposes. There has likely been some use of pack goats in the Cloud Peak Wilderness, which may be of some risk to the SC herd, depending on timing and location.</p> <p>There are domestic goats/sheep proposed for use in the bottom of Little Bighorn drainage/Dry Fork associated with Alternative 3 of the Big 6 project, which are far enough away from Devils Canyon to negate concern of contact. There are domestic goats used near the Bighorn Canyon NRA herd which have potential to interact, and thereby potentially interacting and transferring disease to the Devils Canyon herd since these two herds likely interact. These domestic goats are not under USFS control.</p> <p>Finally, there is a possibility that domestic goat packing (recreational – non-permitted) could occur near the Devils Canyon herd such as along the Bucking Mule trail. Both signing and closure through special order may be necessary if any domestic goat use becomes evident in this area (Bald Mtn. Campground, 5 Springs Campground, Porcupine Campground, Bucking Mule trailhead, JAWS trailhead, Medicine Wheel visitor site, etc.).</p>	<p>This measure was added to Alternative 3 – FEIS as follows:</p> <p>If necessary, use Special Order authority and associated signing to close the area west of Sheep Mtn. road and north of Hwy 14A to recreational goat packing to reduce potential contact with bighorn sheep. Similarly, do not allow goat or sheep in this area for weed control purposes.</p>
All	Revisit the findings of this risk assessment after 5 years for validation.	Revisiting this risk assessment would indicate if conditions have changed, if opportunities have arisen, if design criteria and adaptive management	This was included as new design criteria with Alternative 3 – FEIS.

Risk Factor	Potential Actions	Discussion	Disposition
		strategies have succeeded or failed, and if other measures are warranted.	
All	Provide signing to educate public and permittees in the area near Devils Canyon bighorn sheep herd to report any comingling with domestic sheep.	Should the DC herd expand and more readily use the area down to Hwy 14A, despite management efforts by WGFD to keep them north of this area, signing may help increase the reporting vigilance to notify WGFD and USFS of any potential contact that may be occurring.	This measure was added to Alternative 3 – FEIS as follows: Provide signing in the area west of Sheep Mtn. road and north of Hwy 14A to inform public of the contact issue and to provide reporting guidance for any contact observed.
All	Herders may be added when trailing	If during trailing or allotment herding practices, the need for an additional herder is identified to reduce potential contact; the permittee(s) may add herders as appropriate.	This element was added to the SEIS as an adaptive strategy.

Consideration of 2010 WFWA Recommendations for Minimizing Potential Bighorn/Domestic Sheep Interactions - Land Management Agencies

Recommendation	Disposition and Consideration
Joint federal land management agency guidelines on management of domestic sheep and goats in wild sheep habitat should be developed and included in both broad agency policy documents (ie. USFS Manuals) and local Forest Plan/Resource Management Plans.	This recommendation was incorporated through the 2005 Forest Plan, and supplemented with this project analysis.
Land management agencies responsible for domestic sheep and goat grazing allotments, trailing routes, vegetation management (e.g., weed control, enhancement of conifer regeneration), use as pack stock, or any other uses involving domestic sheep and goats should only authorize such use where mechanisms are in place to achieve effective separation with wild sheep.	This recommendation is inherent to the analysis conducted for this project.
Land management agencies should require prompt notification of interaction between wild sheep and domestic sheep and goats by permittees and their herders. Notification procedures (including phone numbers/contact information for permittees, and use of satellite phones in backcountry settings) should be included in the Annual Operating Instructions for grazing allotments and trailing permits.	This recommendation is considered above, and was incorporated as design criteria, and adaptive management strategies.
Land management agencies should map active vs. inactive domestic sheep and goat grazing allotments/trailing routes, including information on dates of use and contact information for the responsible grazing/trailing permittee.	This recommendation was incorporated into the analysis for this project, and the District maintains permittee contact information.
Ensure advance written instructions (such as USFS Annual Operating Instructions) exist, addressing management, retrieval, and disposition of stray domestic sheep and goats left on public lands prior to and/or after grazing/trailing/permited on- and off-dates.	This direction would be contained in the AOIs for domestic sheep allotments associated with this project and would include notification of the appropriate party regarding strays.
Collaboratively with state/provincial wildlife and agricultural interests, written agreements should be developed as to management, retrieval, and disposition of stray domestic sheep and goats occurring on public lands where there is no grazing/trailing allotment, nor permitted use. Furthermore, these agreements should address feral sheep and goats as well as other exotic breeds (e.g., aoudad, Iranian red sheep, urial, argali) that range free on public lands.	This issue has not been a factor in the project area, as all domestic sheep are administered through permits. WY State statutes dictate stray livestock policies.
Review domestic sheep boundaries and trailing routes. Reconfigure boundaries or trailing routes where feasible to avoid or minimize overlap with occupied wild sheep habitat.	This process was inherent in this analysis.

Recommendation	Disposition and Consideration
Undertake habitat enhancements that improve wild sheep habitat outside allotment boundaries to attract wild sheep away from domestic sheep.	This activity has occurred associated with the Devils Canyon herd, and to a lesser extent, the Shell Canyon herd. Allowance for this occurs within the Forest Plan.
Undertake water developments to enhance bighorn distribution or to move domestic sheep away from wild sheep range.	This was considered in the table above.
Annual Operating Instructions should require careful management and vigilant herding to minimize/avoid wild sheep interaction with stray domestic sheep and goats. If appropriate, a count-on, count-off inventory of domestic sheep and goats may be required as a condition of operation.	Herding is the standard procedure associated with domestic sheep grazing on the Forest, and is Design Criteria 19 in DEIS. The option of counting is included as an adaptive management strategy, and is design criteria 24 in the DEIS. Both carried into FEIS.
In areas of high risk of contact, trucking should be required, since trailing may result in additional management risks. Trucking of domestic sheep and goats is preferred to trailing, since there is less chance of stray domestics, and less chance of opportunistic contact by wandering wild sheep, particularly when domestic ewes are in estrus.	The option of trucking was included as an adaptive management strategy in the FEIS.
If trailing occurs, on-site compliance monitoring to minimize strays should be conducted by the permittee and/or the land management agency. In areas of highest risk, use of wild sheep advocates as volunteers to assist with compliance monitoring should be explored.	Checking for strays and counting is part of the design criteria in the DEIS and carried into the FEIS. Any party could use volunteers at any time to help with the separation.
Land Use/Resource Management Plans, where relevant, should specifically address the issue of potential domestic sheep and goat interaction with wild sheep.	<p>The Revised Forest Plan addressed this recommendation.</p> <p>Substantial work was completed between the DEIS and FEIS analyzing the issue of potential domestic sheep and goat interaction with wild sheep. A risk assessment was conducted; additional actions were included in Chapter 2 of the FEIS; the Forest Plan bighorn sheep viability analysis was reviewed and the Biological Evaluation updated.</p>
Land management agencies should coordinate closely with appropriate entities involved in weed control programs (e.g., local Weed & Pest Districts, University Experiment Stations, private landowners) using domestic sheep and goats on public lands, adjoining private lands, or state/provincial wildlife habitat management areas.	There has been no use of domestic goats or sheep on the Bighorn NF to control weeds. The only proposal in the Big 6 project for this type of use is within areas that have a very low to no chance of interaction with bighorn sheep.
Where topography, vegetation, and other abiotic/biotic parameters are suitable, conversion from domestic sheep and goats to other classes of domestic livestock that do not pose a disease risk to wild sheep should be carefully considered when	<p>This recommendation is a feature of the analysis for this project.</p> <p>Under alternative 3, the Grouse Cr S&G allotment is converted to a C&H allotment.</p>

Recommendation	Disposition and Consideration
permitting grazing allotments and pack animal outfitting.	
Stocking of allotments not currently under permit to domestic sheep and goats under emergency conditions (e.g., reduced forage available in permitted allotment areas due to wildfire or drought) should only be permitted after adequate risk assessment has been completed. This assessment can be completed via project-level NEPA analysis.	This recommendation is a feature of the analysis for this project.
Land management agencies should incorporate state/provincial wild sheep management plans either in, or supplemental to, federal Resource or Land Use Management Plans. Land management agencies should collaborate with state/provincial wildlife agencies on comprehensive risk assessments (Clifford et al. 2007) of domestic sheep and goat grazing allotments or trailing routes in wild sheep habitat, to assess risk of contact with wild sheep. Adequate training (e.g., workshops, manuals) should be provided to agency staff to conduct risk assessments.	<p>The Revised Forest Plan and this project incorporate by reference Wyoming's Interagency Domestic/Wild Sheep Working Group Recommendations (WGFD 2004).</p> <p>Prior collaboration with this group moved a domestic sheep permittee from the Shoshone NF to the Bighorn NF to protect the highly valued herd on that Forest.</p>
Where mandatory buffer zones (9 miles) between domestic sheep or goats and wild sheep have been used to minimize association, it should be recognized that buffer zones apply to herds or populations, rather than individual wandering wild sheep and buffer zones may not be effective or practical.	This project did not incorporate any mandatory separation buffers. Distance between domestic sheep allotments and bighorn sheep herds were assessed as part of the risk assessment in assigning risk levels.
Topographic features or other natural or man-made barriers (e.g., fenced, interstate highways) can also be effective in minimizing the likelihood of contact between wild sheep and domestic sheep and goats. Site-specific risk assessments should be completed, to evaluate the efficacy using natural barriers, defined buffer zones and other preventive actions to minimize risk. Given the wide range of circumstances across jurisdictions, buffer zones may not be needed in all situations; conversely, buffer zones should not be precluded as an effective strategy to address this issue.	This recommendation is a feature of the analysis for this project, considered under the assessment of risk between bighorn sheep and domestic sheep allotments and trailing.
Land management agencies, in collaboration with state/provincial livestock health agencies, should work with producers/permittees to prevent turnout of sick or diseased domestic sheep and goats on grazing allotments or on trailing routes, or used for weed control or pack stock. Sick or diseased animals on range should be reported to land management or wildlife agency personnel as soon as possible after recognition; after that initial notification, inter-agency coordination should promptly occur. The higher the risk of contact	This is an existing state statute requirement for livestock operators to follow, in terms of management of diseased domestic livestock.

Recommendation	Disposition and Consideration
between domestic sheep and goats with wild sheep, the higher the certainty of domestic animal health should be. It should also be recognized that “healthy-appearing” domestic sheep and goats may still carry pathogens that can be transmitted to wild sheep.	
Proportional to the risk of contact between domestic sheep and goats and wild sheep, land management agencies should work with producers/permittees, state/provincial wildlife agencies, wild sheep advocates, and others, to implement a variety of mitigation strategies (e.g., herders, dogs or other guarding animals trained to repel animals foreign to domestic sheep bands or goat flocks [such as wandering wild sheep, various predators], confinement of domestic sheep and goats at night to minimize strays, adequate fencing configurations covenants, allotment retirements, conversion of class of livestock, trucking vs. trailing, etc.) designed to achieve the most effective separation possible.	This recommendation was considered during the development of the proposed action and was included to the extent warranted in the design criteria and adaptive management strategies.
Land management and state/provincial wildlife agencies should cooperatively manage for healthy wild sheep habitat. Agencies should routinely monitor wild sheep habitat to detect changes in habitat quality or condition, and as needed and appropriate, conduct habitat enhancements (e.g., prescribed burning, pre-commercial thinning, salting, mineral supplements, water development, etc.) to encourage wild sheep to remain in wild sheep habitats, away from domestic sheep and goat use areas.	While no formal monitoring of sheep habitat is conducted on the Forest, qualitative assessments occur in conjunction with the WGFD, commensurate with the management effort applied to the sheep herds near or on the Forest
In areas where contact between wild sheep and domestic sheep and goats is likely, land management agencies should post advisory signs at trailheads, campgrounds, and other popular, high-use recreational areas, to educate visitors about the issue of interaction, and to encourage prompt reporting of wild sheep contact with domestic sheep and goats. Furthermore, individuals accompanied by pets (i.e., dogs) should ensure that those dogs remain under their control, and do not disturb or scatter domestic sheep and goats in permitted areas.	There are no destination trailheads within the project area where potential domestic goat use (pack animals) has occurred. However, allowance for this potential use in the future was assessed, and an adaptive management strategy for signing was developed for the FEIS.
Land management agencies should clearly define the process, protocols, and timelines for short-term or emergency management actions when intervention is needed to minimize or eliminate the risk of interaction between wild sheep and domestic sheep and goats.	This recommendation would be a component of the proposed action through the design criteria and adaptive management strategies.
Risk assessment should be conducted on an appropriate geographic scale, regardless of	This process was a component of analysis for this project.

Recommendation	Disposition and Consideration
jurisdictional boundaries. Recognizing the limits of regulatory authority, land management agencies should consider private lands (i.e., either adjacent to, or in-holdings of, federal land) contributing to that disease risk when conducting risk assessments.	
Land management agencies should closely evaluate the timing of permitted domestic sheep and goat grazing and/or trailing activities, to reduce disease transmission risk. For example, grazing domestic sheep when ewes are in estrus heightens the possibility of contact between wild sheep and domestic sheep. Effective separation should be based on temporal and spatial separation of wild sheep and domestic sheep and goats, based on the seasonally differential vulnerability of wild sheep exposure to domestic sheep and goats.	This recommendation is a feature of the analysis, design criteria, and adaptive management strategies associated with this project.
In areas with risk of contact between wild sheep and domestic sheep and goats, agencies and permittees should pursue enhanced monitoring of domestic sheep and goat grazing and/or trailing patterns via use of high-tech Global Positioning System collars or other technology that would provide detailed data on movements and grazing patterns of domestic sheep and goats.	GPS collars were applied to bighorn sheep associated with the Shell Canyon herd in 2007 to monitor the potential for contact with domestic sheep, and similar monitoring has occurred for the Devils Canyon herd. Continued monitoring is part of the adaptive management strategies for this project. Monitoring of domestic sheep was assessed through the requirement of full time herders and counting measures.

APPENDIX B: RATIONALE / JUSTIFICATION FOR RISK RATING OF INDIVIDUAL ALLOTMENTS AND BIGHORN SHEEP HERD BY INTERDISCIPLINARY TEAM (DECEMBER 1, 2010).

This includes all sheep and goat allotments within the Big 6 area, and pertains to domestic sheep grazing permitted by the Forest Service only. The rationale listed below demonstrates the logic of risk ratings shown in Risk Ratings Tables located in the main document.

Beaver Creek and Little Horn Project Area Allotments

In the explanation of risk ratings below, there are references to the “5% outer limit area”. Estimates were made as to the distance of a grazing allotment boundary in relation to the closest proximity to the 5% outer limit area. The majority of the 5% outer limit area is tied to seasonal movements of bighorn sheep out from the 95% core herd areas. Where this is the case, there is no further explanation of what the 5%[^] means. There are however, a few instances where the “5% outer limit area” is actually associated with wandering bighorn sheep movements. Where this is the case, there is an explanation that specifies the 5% outer limit area is associated with a specific bighorn sheep movement pattern.

Antelope Ridge S&G

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The distance of this allotment from the core 95% bighorn sheep area is at least 8 air miles, and this distance is separated by some more heavily timbered areas that would lessen movement of bighorn sheep. The topography of Shell Canyon serves as a barrier to lessen stray domestic sheep movement. However, the distance from the allotment to the Shell Canyon 5% outer limit area is about 4 air miles. This outer limit is tied to wandering bighorn sheep at the time of rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th, unless emergency conditions arise, such as extreme weather events. Even when the Shell Canyon herd was 100+ animals, they were never known to locate to this area. In addition, non-habitat (dense timber) will probably preclude any wild sheep movement to that area. The risk rating is **low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Devils' Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 6 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering bighorn sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon (North of Highway 14A). Therefore the risk rating is **low**.
- Alternative 3. The risk rating would be the same as Alternative 2 above. If however an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNRA Herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for interaction rating 3). The allotment is separated from BCNRA herd by additional timber barriers, canyon topography, and is approximately 25 air miles from the 5% outer limit area. The risk rating is **very low**.
- Alternative 3. The risk rating would be the same as Alternative 2 above. If however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Bear/Crystal Creek S&G

Shell Canyon Herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is overlap of a portion of the allotment and the 5% outer limit GIS layers (potential for contact rating of 5). The 5% outer limit areas are tied to wandering bighorn rams during the rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. The risk rating is **moderate**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Devils canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment boundary is approximately 1 air mile from the 5% outer limit; which is mostly tied to wandering bighorn sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The allotment is separated from the 95% core herd area by timber barriers and steep canyon topography. The risk rating is **moderate**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNPS herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for a contact rating of 3). The allotment is approximately 20 air miles from the 5% outer limit area. In addition the allotment is separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Beaver Creek S&G

Shell Canyon Herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There are overlap of the 5% outer limit and the west portion (Bear Creek Mesa) of the Beaver Creek allotment on the forest boundary (potential of contact rating is 5). No domestic sheep grazing has occurred on Bear Creek Mesa since the 1980's, but is specified as a forage reserve under current management. The remaining portion of the allotment (east) is also within about 1 mile of the 5% outer limit area. The 5% outer limit areas are tied to wandering bighorn rams during the rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. The risk rating is **moderate**.
- Alternative 3. There are overlap of the 5% outer limit and the west portion of the Beaver Creek allotment on the forest boundary (potential of contact is 5), however under alternative 3 this west portion (Bear Creek Mesa) is not considered suitable range, and will not be included in the rotation. The remaining portion of the allotment (east) is also within about 1 mile of the 5% outer limit area. The 5% outer limit areas are tied to wandering bighorn rams during the rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. The distance of this allotment from the core 95% bighorn area is about 7 air miles, and this distance is separated by some timbered areas that would lessen movement of bighorn sheep. The topography of Shell Canyon serves as a barrier to lessen stray domestic sheep movement. The risk rating is **moderate**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating 3). The allotment is approximately 5 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The allotment was given a risk rating of **low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNRA herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating 3). The allotment is approximately 25 air miles from the 5% outer limit area. The allotment is separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Grouse Creek S&G

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is overlap between the allotment and the 95% core area of the Shell Canyon herd (potential for contact is 6). Most of the overlap is within the 5% outer limit, but a small portion of the allotment does overlap with the 95% core herd area. The allotment is presently considered vacant; because the permitted sheep were moved to an adjacent allotment in 1990, and no term grazing permit is attached to the allotment. No sheep have grazed on it since 1990, and there is no intention of stocking it with domestic sheep. As a vacant allotment, however, it could be stocked with domestic sheep, and if this were to occur it would have a risk rating of **high**.
- Alternative 3. This allotment is converted from sheep to cattle under this alternative, so there is a risk rating of **none**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 15 air miles from the 5% outer limit and the allotment is separated by timber barriers and canyon topography. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. Should this allotment be stocked with domestic sheep, the risk rating is **very low**.
- Alternative 3. The allotment is converted from sheep to cattle under this alternative, so there is a risk rating of **none**.

BCNRA herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3), and the allotment is separated by timber barriers, canyon topography, and at least 25 air miles. Therefore the risk rating is **none**.
- Alternative 3. The allotment is converted from sheep to cattle under this alternative, so there is a risk rating of **none**.

Hunt Mt S&G

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is overlap of part of the allotment layer with the 5% outer limit layer (potential for contact rating is 5). The 5% outer limit area is tied to wandering bighorn rams during the rut. This is a very small part of the allotment. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. The rest of the allotment is within 1 mile of the 5% outer limit of the seasonal movements of the core herd. This allotment is presently vacant, but one pasture (not within 5% outer area) has been stocked periodically with sheep since the early 1990's with an adjacent allotment. As a vacant allotment, however, it could be stocked with domestic sheep, and if this were to occur it would have a risk rating of **high**.

- Alternative 3. There is overlap of part of the allotment layer with the 5% outer limit layer in two areas (potential for contact rating is 5). The 5% outer limit area is tied to wandering bighorn rams during the rut. This is a very small part of the allotment. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. The rest of the allotment is within 1 mile of the 5% outer limit of the seasonal movements of the core herd. Under this alternative the allotment would be a forage reserve and all or part of the allotment could be stocked periodically with domestic sheep. The 5% outer limit is a small portion of the allotment that overlaps, but during periods when the allotment would be stocked, the risk rating would be **high**. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 5 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. As a result, the risk rating is **low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNPS herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 25 air miles from the 5% outer limit area. The allotment is separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Little Horn S&G

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The distance of this allotment from the bighorn 95% core area is at least 8 air miles, and this distance is separated by some timbered areas that would lessen movement of bighorn sheep. The topography of Shell Canyon serves as a barrier to lessen stray domestic sheep movement. The distance from the allotment to the Shell Canyon 5% outer limit area is about 2 air miles. This outer limit is tied to wandering bighorn sheep at the time of rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. Even when the Shell Canyon herd was 100+

animals, they were never known to locate to this area. In addition, non-habitat (dense timber) will probably preclude any wild sheep movement to that area. The risk rating is **low**.

- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 6 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The risk rating is **low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNRA Herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 25 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep. The allotment is also separated from the BCNRA herd by timber barriers and canyon topography. The risk rating is **very low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Red Canyon S&G

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is overlap of part of the allotment layer with the 5% outer limit area (potential for contact rating is 5). This is on the southernmost tip of the allotment, but is related to the 5% outer limit of the core herd. This allotment is presently vacant, but it could be stocked with domestic sheep. It is considered to have a risk rating of **high** when stocked.
- Alternative 3. There is overlap of part of the allotment layer with 5% outer limit layer (potential for contact rating is 5). Under this alternative the allotment would be a forage reserve and all or part of the allotment could be stocked periodically with domestic sheep. It is not expected to occur often due to inadequate water. This is a very small portion of the allotment that overlaps, but during periods when the allotment would be stocked, the risk rating would be **high**, due to overlap on southern boundary. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 8 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering bighorn sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to

managing against bighorn sheep wandering south of Cottonwood Canyon. Therefore, the risk rating is **low**.

- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNPS herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 25 air miles from the 5% outer limit area. The allotment is separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Whaley Creek S&G

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is overlap of a portion of the allotment and the 5% outer limit GIS layers (potential for contact rating is 5). The 5% outer limit areas are tied to wandering bighorn rams during the rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. The risk rating is considered **moderate**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment boundary is approximately 1 air mile from the 5% outer limit; which is mostly tied to wandering bighorn sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The allotment is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **moderate**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

BCNPS herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 20 air miles from the 5% outer limit area. The allotment is separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.
- Alternative 3. The risk rating would be same as Alternative 2 above. If, however, an adaptive strategy is implemented in which domestic sheep grazing is removed from the allotment, the risk rating would become **none**.

West Pass goats

Shell Canyon herd

- Alternative 1. No domestic goat grazing is permitted so risk is **none**
- Alternative 2. No domestic goat grazing at present nor permitted so risk is **none**.
- Alternative 3. There is no overlap of any bighorn or domestic goats in GIS (potential for contact rating is 3). The allotment is about 15 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **very low**. If this adaptive management strategy from the West pass C&H allotment is not implemented then the risk rating is **none**.

Devils Canyon herd

- Alternative 1. No domestic goat grazing is permitted so risk is **none**.
- Alternative 2. No domestic goat grazing at present nor permitted so risk is **none**.
- Alternative 3. There is no overlap of any bighorn or domestic goats in GIS (potential for contact rating is 3). The allotment is about 14 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **very low**. If this adaptive management strategy from the West Pass C&H allotment is not implemented then the risk rating is **none**.

BCNPS herd

- Alternative 1. No domestic goat grazing is permitted so risk is **none**
- Alternative 2. No domestic goat grazing at present nor permitted so risk is **none**
- Alternative 3. There is no overlap of any bighorn or domestic goats in GIS (potential for contact rating is 3). The allotment is about 25 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **very low**. If this adaptive management strategy from the West Pass C&H allotment is not implemented then the risk rating is **none**.

Sage Basin goats

Shell Canyon herd

- Alternative 1. No domestic goat grazing is permitted so risk is **none**
- Alternative 2. No domestic goat grazing at present nor permitted so risk is **none**
- Alternative 3. There is no overlap of any bighorn or domestic goats in GIS (potential for contact rating is 3). The allotment is about 20 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **very low**. If this adaptive management strategy from the Sage Basin C&H allotment is not implemented then the risk rating is **none**.

Devils Canyon herd

- Alternative 1. No domestic goat grazing is permitted so risk is **none**
- Alternative 2. No domestic goat grazing at present nor permitted so risk is **none**
- Alternative 3. There is no overlap of any bighorn or domestic goats in GIS (potential for contact is rating 3). The allotment is about 10 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **very low**. If this adaptive management strategy from the Sage Basin C&H allotment is not implemented then the risk rating is **none**.

BCNPS herd

- Alternative 1. No domestic goat grazing is permitted so risk is **none**
- Alternative 2. No domestic goat grazing at present nor permitted so risk is **none**
- Alternative 3. There is no overlap of any bighorn or domestic goats in GIS (potential for contact rating is 3). The allotment is about 20 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **very low**. If this adaptive management strategy from the Sage Basin C&H allotment is not implemented then the risk rating is **none**.

Trailing via Hwy 14A

Shell Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of any bighorn sheep or highway 14A trailing routes in GIS (potential for contact rating is 3). The Hwy 14A trailing route stops at the north end of the Bear Creek/Crystal Creek S&G allotment boundary and is about 1 mile from the 5% outer limit area. It should be noted that the overlap in the 5% outer limit area is tied to wandering radio collared bighorn sheep during November and December. Rams are in rut mid October through November, and this time period **would** present the highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only trailing up or down Hwy 14A in late June and late September. This trailing is only 3- 5 days versus season long use. Stray sheep along the route could present a risk if a wandering bighorn came north and a stray went south. The risk rating is **low**.
- Alternative 3. There is no overlap of any bighorn sheep or highway 14A trailing routes in GIS (potential for contact rating is 3). The trailing route stops at the north end of the Bear Creek/Crystal Creek S&G allotment boundary and is about 1 mile from the 5% outer limit area. It should be noted that the overlap in the 5% outer limit area is tied to wandering radio collared bighorn sheep during November and December. Rams are in rut mid October through November, and this time period would present the highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimal however, because domestic sheep are only trailing up or down Hwy 14A in late June and late September. Stray sheep along the route could present a risk if a wandering bighorn came north and a stray went south. Design criteria and adaptive strategies should minimize the risk and this made a risk rating of **very low**. If trucking became a requirement due to ineffectiveness of other adaptive strategies, this risk could go to **none**.

Devils Canyon herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. The trailing does not go through the core area, but there is overlap of GIS layers for the trailing route and the 5% outer area on forest (potential for contact rating is 5). The 5% are wandering bighorn sheep as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. Trailing only takes 3-5 days and is not during the rut period. The risk is rated **high**.
- Alternative 3. The trailing does not go through the core area, but there is overlap of GIS layers for the trailing route and the 5% outer limit areas on forest (potential for contact rating is 5). The 5% outer limit areas are wandering bighorn sheep as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated out of the area. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. Trailing only takes 3-5 days and is not during the rut period. Use of previously tested and published design criteria should minimize the risk and this made a risk rating of **moderate**. If trucking became a requirement due to ineffectiveness of other adaptive strategies, this risk could go to **none**.

BCNPS herd

- Alternative 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Alternative 2. There is no overlap of GIS layers for the trailing route and BCNPS herd (potential for contact rating is 3). The trailing on forest is about 10 air miles from the 5% outer limit and is separated from the core herd by timber barriers and steep canyon topography as well. The risk rating is **low**.
- Alternative 3. There is no overlap of GIS layers for the trailing route and BCNPS herd, and they are separated by about 10 air miles, canyon topography, and timber. Design criteria and adaptive strategies could minimize the risk and this made it **very low**.

Tensleep Project Area Allotments

The Tensleep project area includes the Baby Wagon, Garnet, Leigh Creek, Hazelton, McClain Lake, Upper Meadows, and Willow S&G allotments. Also, trailing along the Gold Mine Road may occur.

- Alternative 1: For all these sheep allotments under all 3 bighorn sheep herd scenarios no domestic sheep grazing would be allowed. The risk rating is **none**.
- Alternatives 2 and 3: There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotments are approximately 20 air miles to the 5% outer limit of the Shell herd, 36 air miles to the 5% outer limit of the Devils Canyon herd, and over 40 miles to the 5% outer limit of BCNPS herd. The allotments are separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.

APPENDIX C: MEDICINE WHEEL / PAINTROCK DISTRICT AREA. DETAILED RATIONALE AND JUSTIFICATION FOR RISK RATING FOR ALL DOMESTIC SHEEP ALLOTMENTS NOT CONSIDERED WITHIN THE BIG 6 ANALYSIS UNDER ASSESSMENT 1 (NO GRAZING) AND ASSESSMENT 2 (NO CHANGE – CURRENT MANAGEMENT).

In the explanation of risk ratings below, there are references to the “5% outer limit area”. Estimates were made as to the distance of a grazing allotment boundary in relation to the closest proximity to the 5% outer limit area. The majority of the 5% outer limit area is tied to seasonal movements of bighorn sheep out from the 95% core herd areas. Where this is the case, there is no further explanation of what the 5%[^] means. There are however, a few instances where the “5% outer limit area” is actually associated with wandering bighorn sheep movements. Where this is the case, there is an explanation that specifies the 5% outer limit area is associated with a specific bighorn sheep movement pattern.

Wallrock-Hidden Tepee S&G

Shell Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any GIS layers (potential for contact is 3), however the allotment boundary is immediately adjacent to the 5% outer limit area of the core herd so the risk was rated **high**.

Devils’ Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 10 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated out of the area. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. Therefore the risk rating is **low**.

BCNRA Herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is separated from the BCNRA herd by additional timber barriers, canyon topography, and about 20 air miles. The risk rating is **very low**.

Pole Creek S&G

Shell Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The distance of this allotment from the core 95% bighorn sheep area is at least 8 air miles, and this distance is separated by some more heavily timbered areas that would lessen movement of bighorn sheep. The topography of Shell Canyon serves as a barrier to lessen stray domestic sheep movement. The distance from the allotment to the Shell Canyon 5% outer limit area is about 7 air miles. Even when the Shell Canyon herd was 100+ animals, they were never

known to locate to this area. In addition, non-habitat (dense timber) will probably preclude any wild sheep movement to that area. The risk rating is **low**.

Devils' Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 9 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated out of the area. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. Therefore the risk rating is **low**.

BCNRA Herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is separated from the BCNRA herd by additional timber barriers, canyon topography, and about 20 air miles. The risk rating is **very low**.

Medicine Lodge-Trapper Creek C&H&S&G

Shell Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is about 4 air miles from the 5% outer limit of the Shell Canyon herd. There is thick timber between the allotment and the Shell Canyon herd. Domestic sheep are permitted but infrequently graze the allotment. It is incorporated for use with sheep from the Fishhook/Fool Creek S&G allotment, to provide additional capacity or a rest opportunity on Fishhook/Fool Creek. Medicine Lodge-Trapper Creek allotment is primarily used by cattle, but can have dual use (sheep and cattle). It was last grazed with sheep in 2004 for only about 9 days in combination with the Fishhook/Fool Creek rotation. The risk rating is **low**.

Devils' Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is about 20 air miles from the 5% outer limit of the Devils Canyon herd, and is also separated by thick timber and topographic barriers. Domestic sheep are permitted but infrequently graze the allotment. It is incorporated for use with sheep from the Fishhook/Fool Creek S&G allotment, to provide additional capacity or a rest opportunity on Fishhook/Fool Creek. Medicine Lodge-Trapper Creek allotment is primarily used by cattle, but can have dual use (sheep and cattle). It was last grazed with sheep in 2004 for only about 9 days in combination with the Fishhook/Fool Creek rotation. The risk rating is **very low**.

BCNRA Herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact is 3). The allotment is separated from the BCNRA herd by additional timber barriers, canyon rating topography, and about 30 air miles. The risk rating is **very low**.

Paintrock Basin C&H&S&G

Shell Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3), and domestic sheep are not presently permitted here. The allotment has been grazed by cattle since 1925. In 1974, two sheep allotments were converted to cattle and added to Paintrock Basin allotment. The 1991 EA says sheep could be grazed, however it has only been grazed by cattle. The allotment is at least 10 air miles from the Shell Canyon herd and is also separated by timber and topographic features. The risk rating is **very low**.

Devils' Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3), and domestic sheep are not presently permitted here. The allotment has been grazed by cattle since 1925. In 1974, two sheep allotments were converted to cattle and added to Paintrock Basin allotment. The 1991 EA says sheep could be grazed, however it has only been grazed by cattle. The allotment is at least 25 air miles from the Devils Canyon herd and is also separated by timber and topographic features. The risk rating is **very low**.

BCNRA Herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3), and domestic sheep are not presently permitted here. The allotment has been grazed by cattle since 1925. In 1974, two sheep allotments were converted to cattle and added to Paintrock Basin allotment. The 1991 EA says sheep could be grazed, however it has only been grazed by cattle. The allotment is at least 35 air miles from the BCNRA herd and is also separated by timber and topographic features. The risk rating is **very low**.

Trailing Hunt Mt. road to private

Shell Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is overlap of GIS layers for a portion of the trailing route and the 5% outer limit (potential for contact rating is 5). This trailing route is currently used by a permittee trailing from Fishhook/Fool Creek S&G to private lands off forest for 2-3 days near mid September and is not a long duration use. The bighorn sheep use at the 5% outer limit area can be within the same season as the trailing. This overlap is not along the entire route. Part of the route does go through active domestic sheep allotments. There are no design criteria or adaptive management strategies under current management for this trailing route. The risk rating is **high**. If at a future point, similar adaptive management strategies that are outlined for the Highway 14A trailing route were applied to this trailing, it could reduce the risk.

Devils' Canyon herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). Trailing only occurs over 2-3 days and is located about 15 air miles south of the Devils Canyon herd. The trailing is separated by timber barriers and topography, as well. The risk rating is **low**.

BCNRA Herd

- Assessment 1. No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2. There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). Trailing only occurs over 2-3 days and is located about 25 air miles south of the Devils Canyon herd. The allotment is separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.

APPENDIX D: TONGUE DISTRICT AREA. DETAILED RATIONALE AND JUSTIFICATION FOR RISK RATING FOR ALL DOMESTIC SHEEP ALLOTMENTS NOT CONSIDERED WITHIN THE BIG 6 ANALYSIS UNDER ASSESSMENT 1 (NO GRAZING) AND ASSESSMENT 2 (NO CHANGE – CURRENT MANAGEMENT).

In the explanation of risk ratings below, there are references to the “5% outer limit area”. Estimates were made as to the distance of a grazing allotment boundary in relation to the closest proximity to the 5% outer limit area. The majority of the 5% outer limit area is tied to seasonal movements of bighorn sheep out from the 95% core herd areas. Where this is the case, there is no further explanation of what the 5%[^] means. There are however, a few instances where the “5% outer limit area” is actually associated with wandering bighorn sheep movements. Where this is the case, there is an explanation that specifies the 5% outer limit area is associated with a specific bighorn sheep movement pattern.

Fishhook/Fool Creek S&G

Shell Canyon herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The distance of this allotment from the core 95% bighorn sheep area is at least 8 air miles, and this distance is separated by some more heavily timbered areas that would lessen movement of bighorn sheep. The topography of Shell Canyon serves as a barrier to lessen stray domestic sheep movement. However, the distance from the allotment to the Shell Canyon 5% outer limit area is about 5 air miles. This outer limit is tied to wandering bighorn sheep at the time of rut. Rams rut mid October through November, and this would be highest chance for wandering rams to come in contact with domestic sheep. This risk would be minimized however, because domestic sheep are only permitted through September 30th at the latest. Even when the Shell Canyon herd was 100+ animals, they were never known to locate to this area. In addition, non-habitat (dense timber) will probably preclude any wild sheep movement to that area. The risk rating is **low**.

Devils’ Canyon herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is approximately 10 air miles from the 5% outer limit area. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated out of the area. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The risk rating is **low**.

BCNRA Herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is separated from the BCNRA herd by additional timber barriers, canyon topography, and is approximately 20 air miles from the 5% outer limit area. The risk rating is **very low**.

Owen Creek S&G

Shell Canyon herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is about 3 air miles from the 5% outer limit area, and the southern end of allotment is fenced with woven wire. The risk rating is **moderate**.

Devils' Canyon herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is about 13 air miles from the 5% outer limit area, and is separated by timber barriers and canyon topography. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated out of the area. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The risk rating is **very low**.

BCNRA Herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is separated from the BCNRA herd by additional timber barriers, canyon topography, and is approximately 25 air miles from the 5% outer limit area. The risk rating is **very low**.

Bull Creek-Woodrock S&G

Shell Canyon herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is a slight overlap of GIS layers with the allotment boundary and 5% outer limit on the southern most edge (potential for contact rating is 5). This is a very small portion of the allotment. The allotment is within about 2 air miles of the eastern Shell Canyon 95% core herd area. Bighorn sheep have been known to occupy this area at the same time of season that domestic sheep may be on the allotment. The risk rating is **high**.

Devils' Canyon herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is about 12 air miles from the 5% outer limit area, and is separated by timber barriers and canyon topography. The 5% outer limit area is mostly tied to wandering sheep, as well as a few that took up residence in Cottonwood Canyon. Most of these have since been relocated out of the area. The WGFD has committed to managing against bighorn sheep wandering south of Cottonwood Canyon. The risk rating is **very low**.

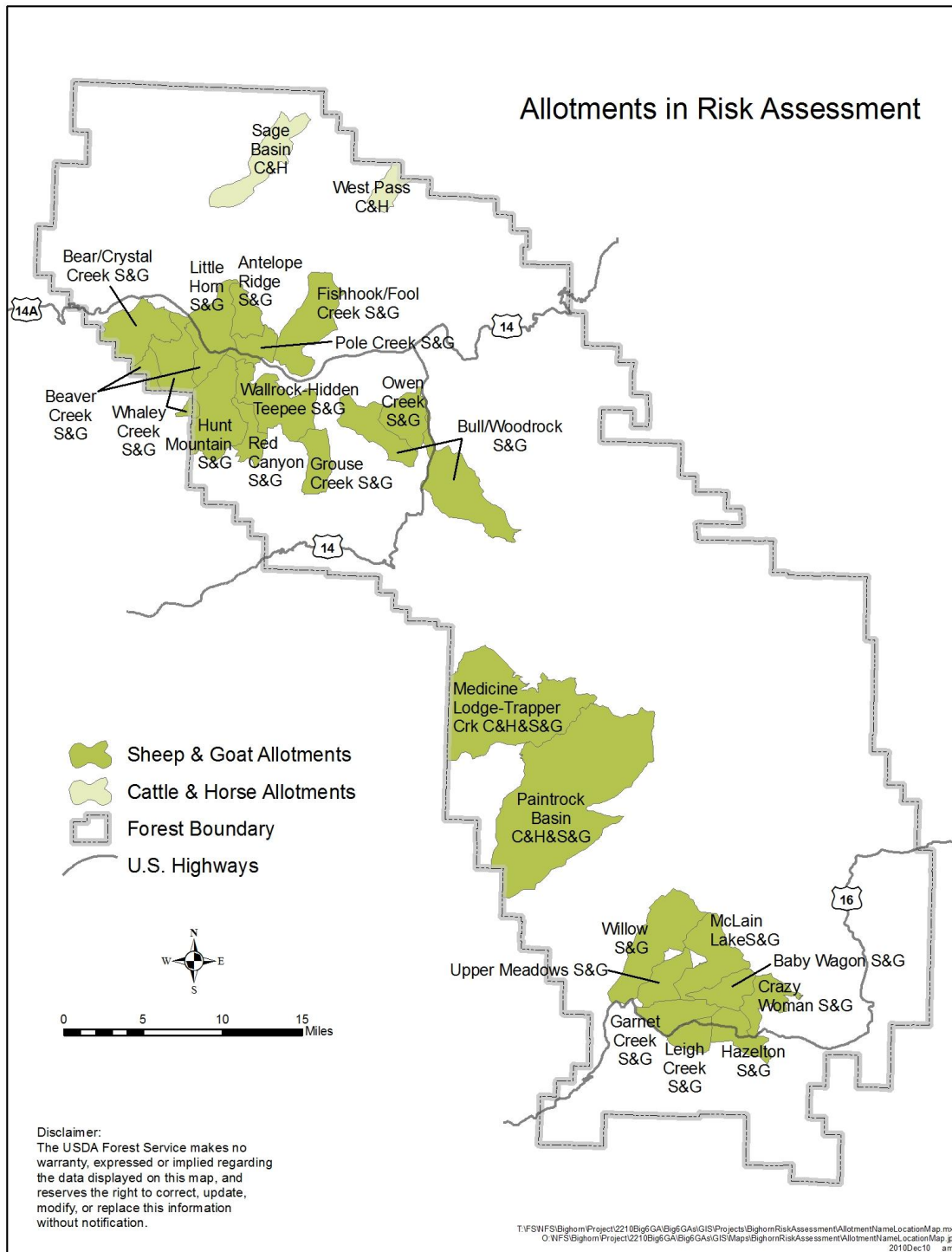
BCNRA Herd

- Assessment 1 No domestic sheep grazing is permitted; therefore the risk rating is **none**.
- Assessment 2 There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotment is separated from BCNRA herd by additional timber barriers, canyon topography, and is approximately 22 air miles from the 5% outer limit area. The risk rating is **very low**.

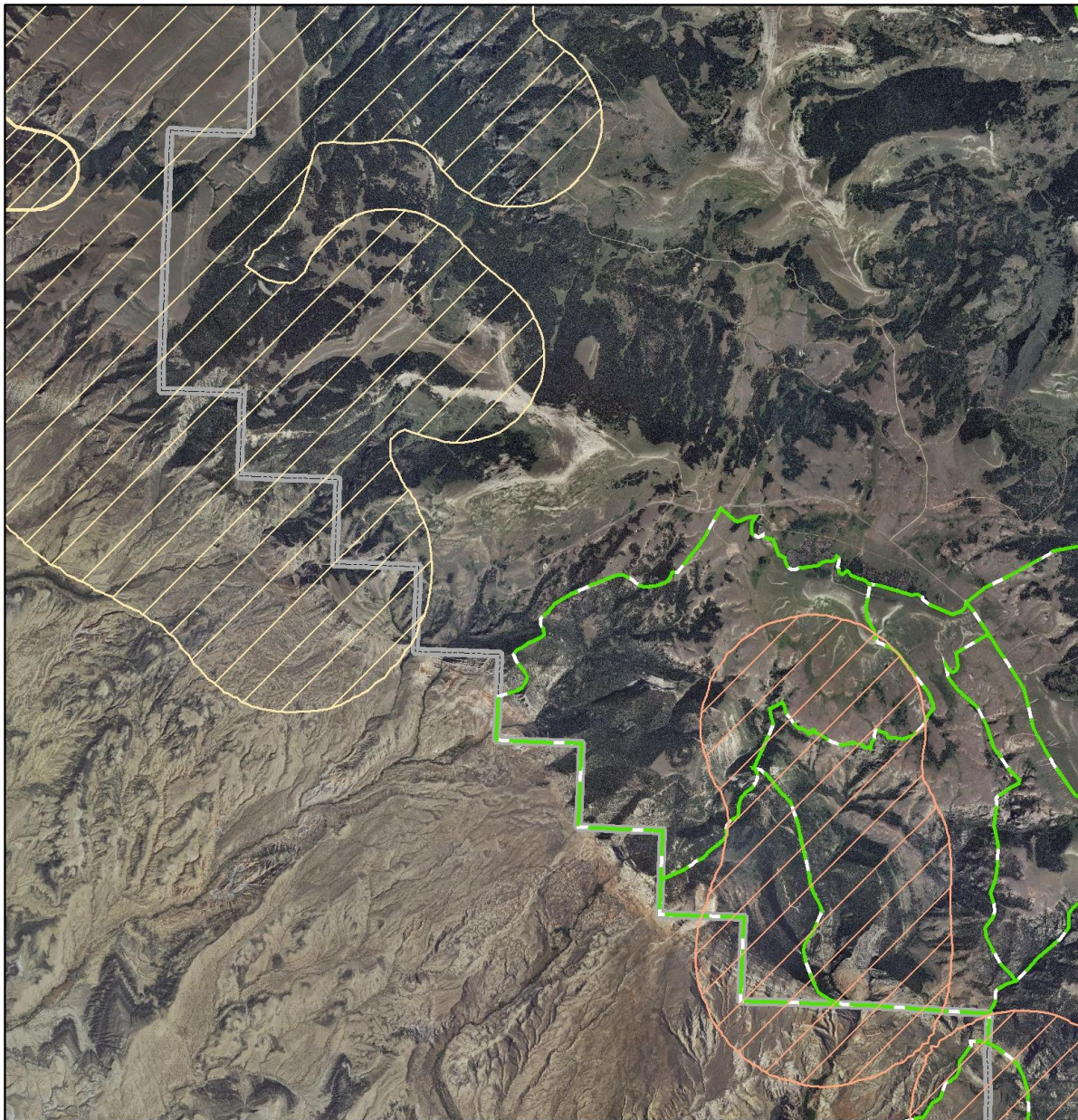
The Powder River Ranger District sheep allotments outside the Big 6 project area includes Crazy Woman S&G, the Crazy Woman Stock Driveway, and the BHA Pack Goats (special use permit)

- Assessment 1: For the sheep allotment, trailing route and goat packing under all 3 bighorn sheep herd scenarios no domestic sheep grazing would be allowed. The risk rating is **none**.
- Assessment 2: There is no overlap of any bighorn or domestic sheep in GIS (potential for contact rating is 3). The allotments are approximately 38 air miles to the 5% outer limit of the Devils Canyon herd, about 22 air miles to the 5% outer limit of the Shell herd, and over 42 miles to the 5% outer limit of BHCNPS herd. The allotments are separated from the BCNRA herd by additional timber barriers and canyon topography. The risk rating is **very low**.

Appendix E. Map Results from Potential Contact GIS Modeling





Forested Vegetation on Bighorn National Forest

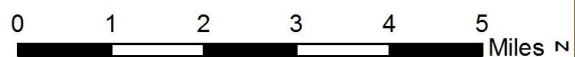


-  Shell Canyon Herd - 5% outer limit
-  Devils Canyon Herd - 5% outer limit
-  Devils Canyon Herd - 95% core area

2009 NAIP Imagery

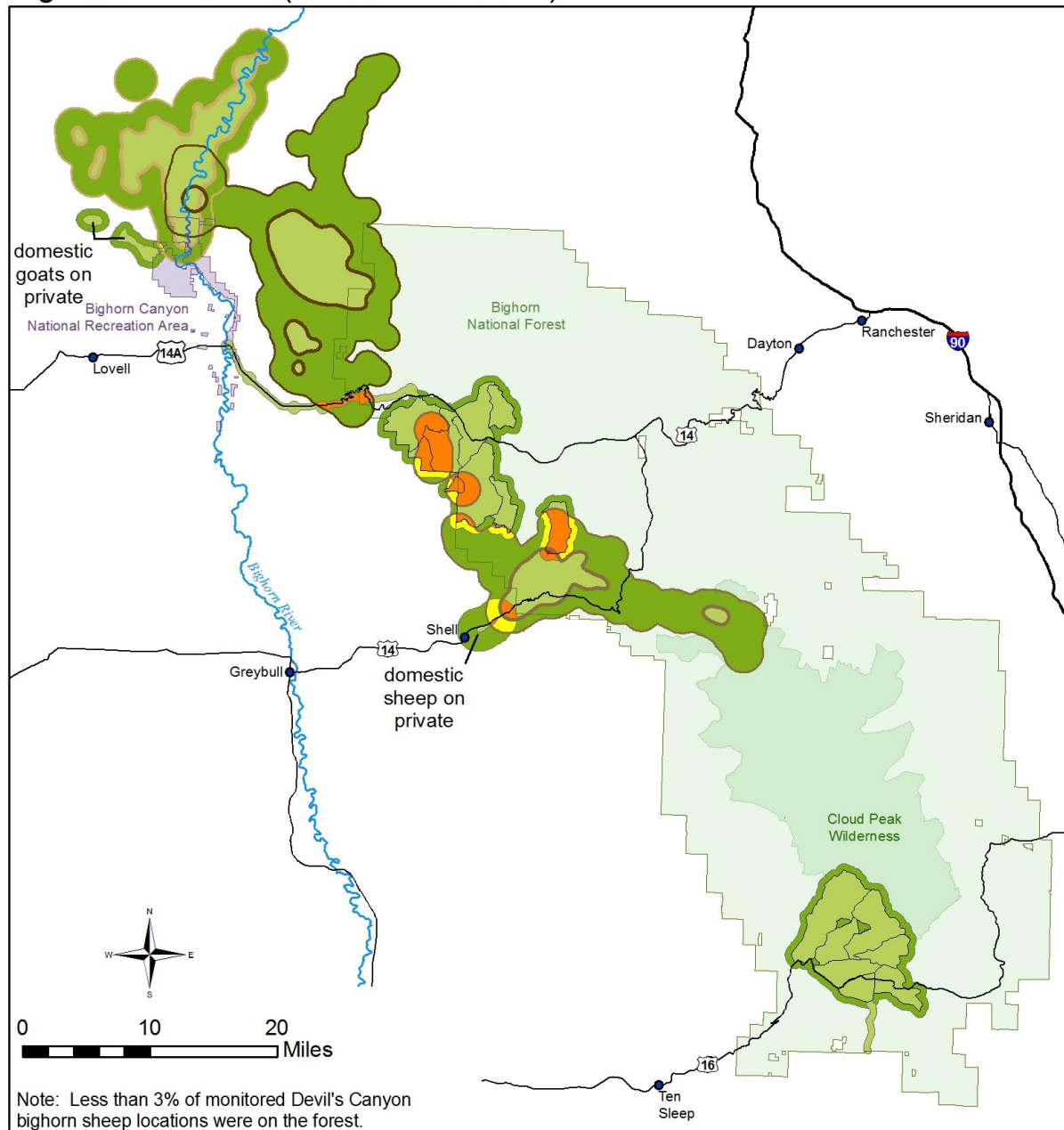
-  Sheep Allotment Boundaries
-  Forest Boundary

Disclaimer:
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20101209 amc

Big 6 Alternative 2 (Current Condition)



Potential for Interaction*



*Refer to document for definition.

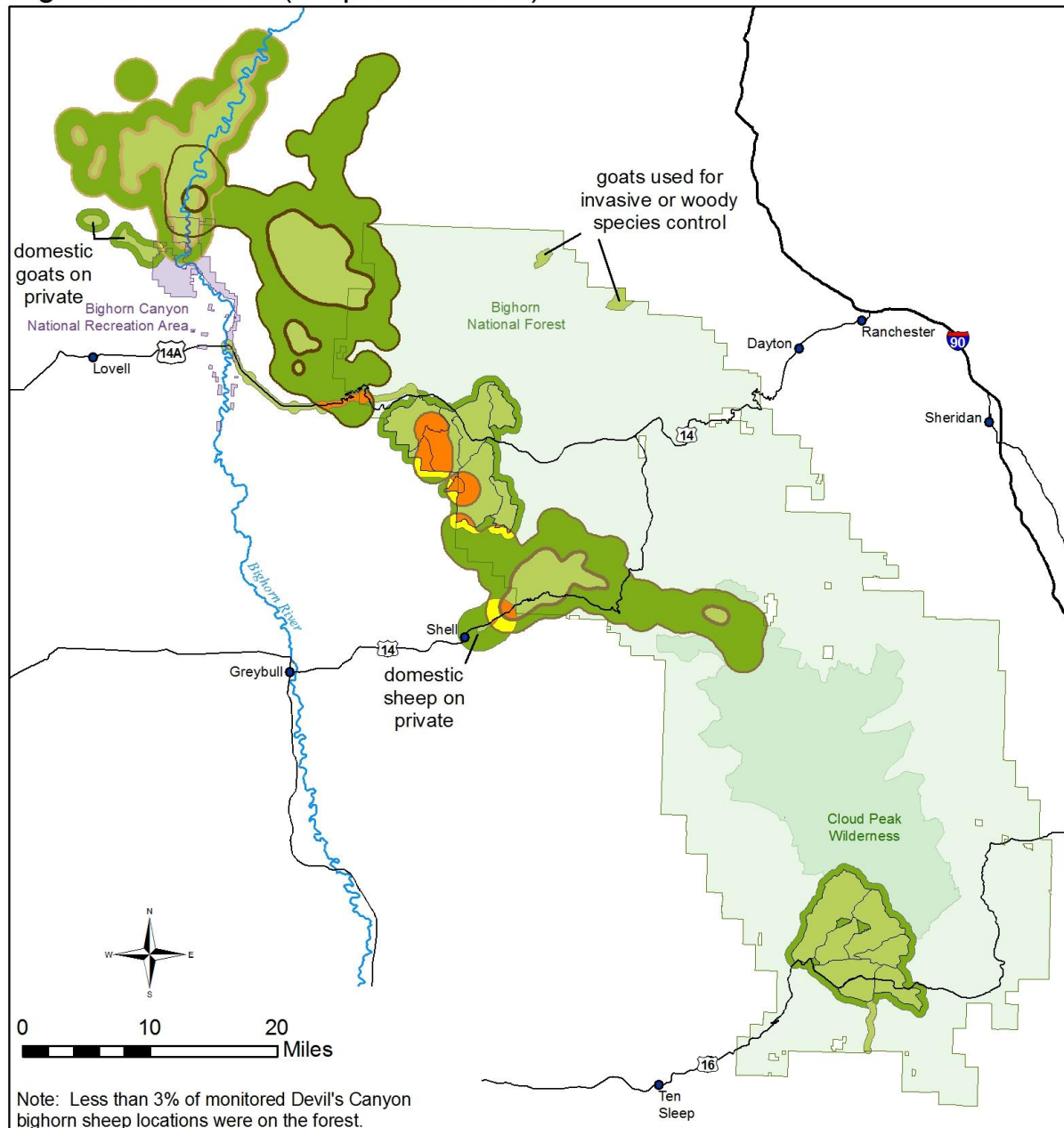
6 only occurs in the SW corner of the Grouse Creek allotment.

- Allotment Boundaries
- Devils Canyon Herd - 95% core area
- Devils Canyon Herd - 5% outer limit
- Shell Canyon Herd - 95% core area
- Shell Canyon Herd - 5% outer limit
- Bighorn Canyon Herd - 95% core area
- Bighorn Canyon Herd - 5% outer limit

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2010Dec10 amo

Big 6 Alternative 3 (Proposed Action)



Potential for Interaction*



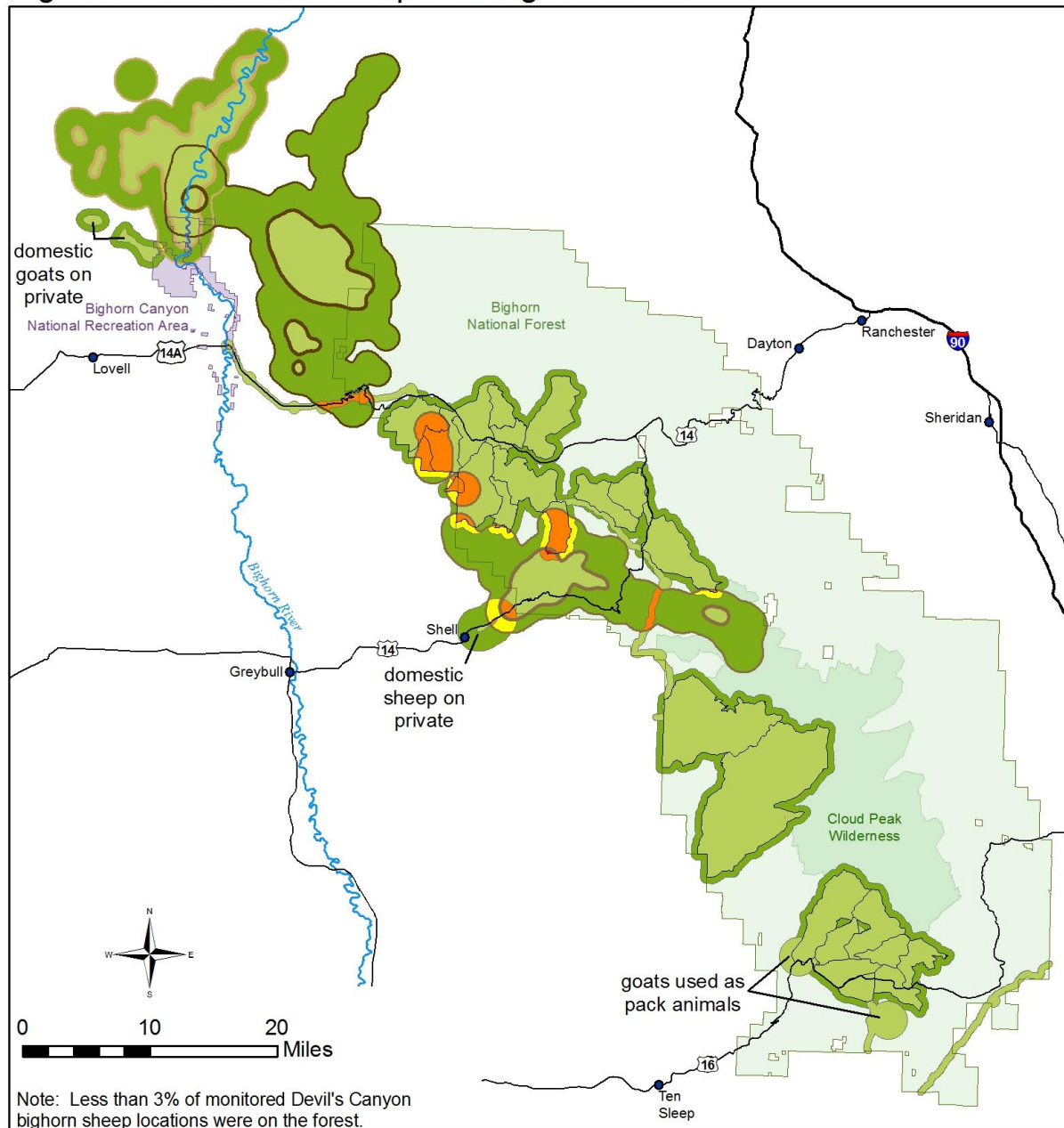
*Refer to document for definition.
6 does not occur in this scenario.

- Allotment Boundaries
- Devils Canyon Herd - 95% core area
- Devils Canyon Herd - 5% outer limit
- Shell Canyon Herd - 95% core area
- Shell Canyon Herd - 5% outer limit
- Bighorn Canyon Herd - 95% core area
- Bighorn Canyon Herd - 5% outer limit

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2010Dec10 amo

Big 6 Alt. 2 + Current Sheep Grazing on Forest



Potential for Interaction*



*Refer to document for definition.

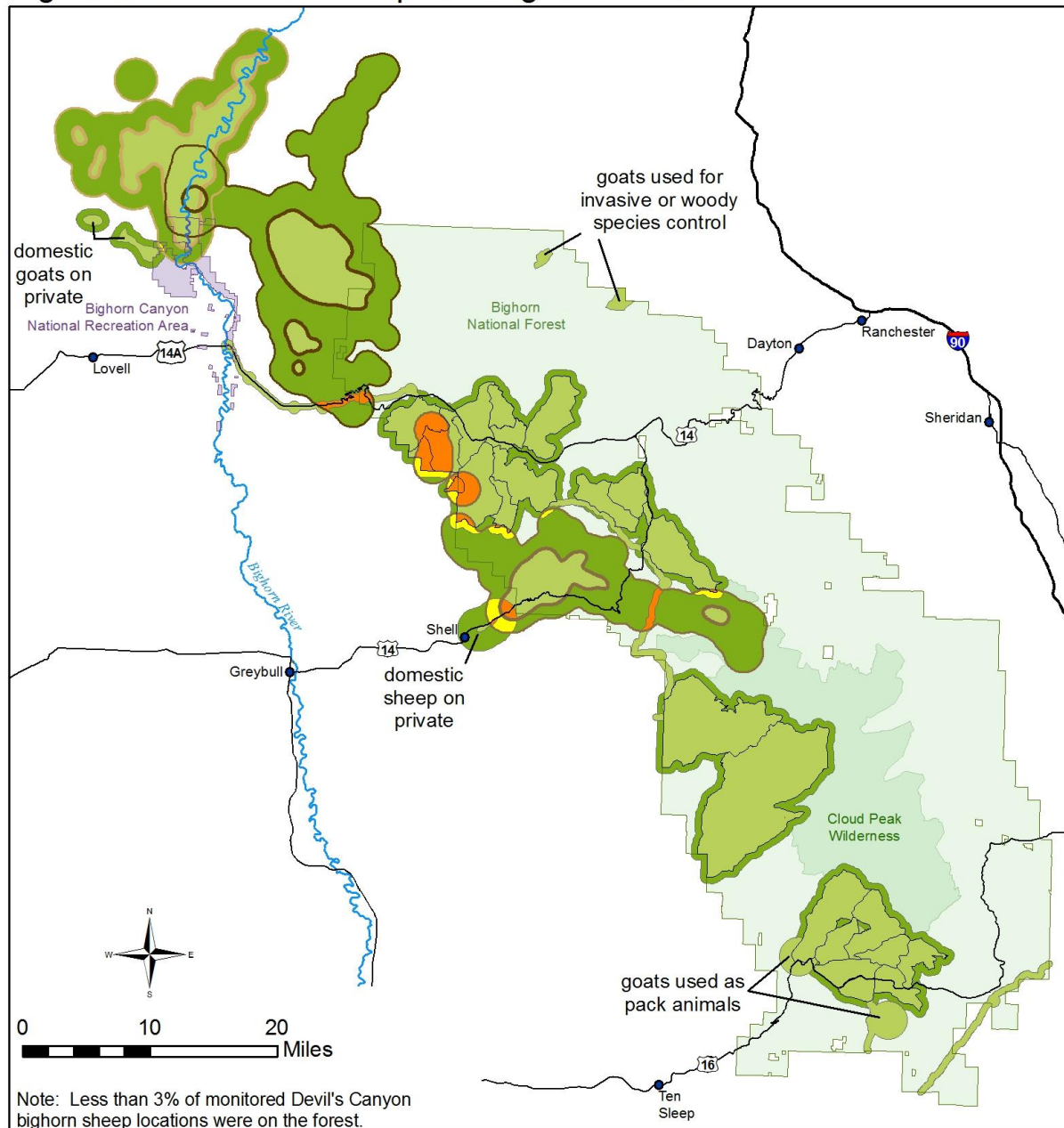
6 only occurs in the SW corner of the Grouse Creek allotment.

- Allotment Boundaries
- Devils Canyon Herd - 95% core area
- Devils Canyon Herd - 5% outer limit
- Shell Canyon Herd - 95% core area
- Shell Canyon Herd - 5% outer limit
- Bighorn Canyon Herd - 95% core area
- Bighorn Canyon Herd - 5% outer limit

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2010dec10 amo

Big 6 Alt. 3 + Current Sheep Grazing on Forest



Potential for Interaction*



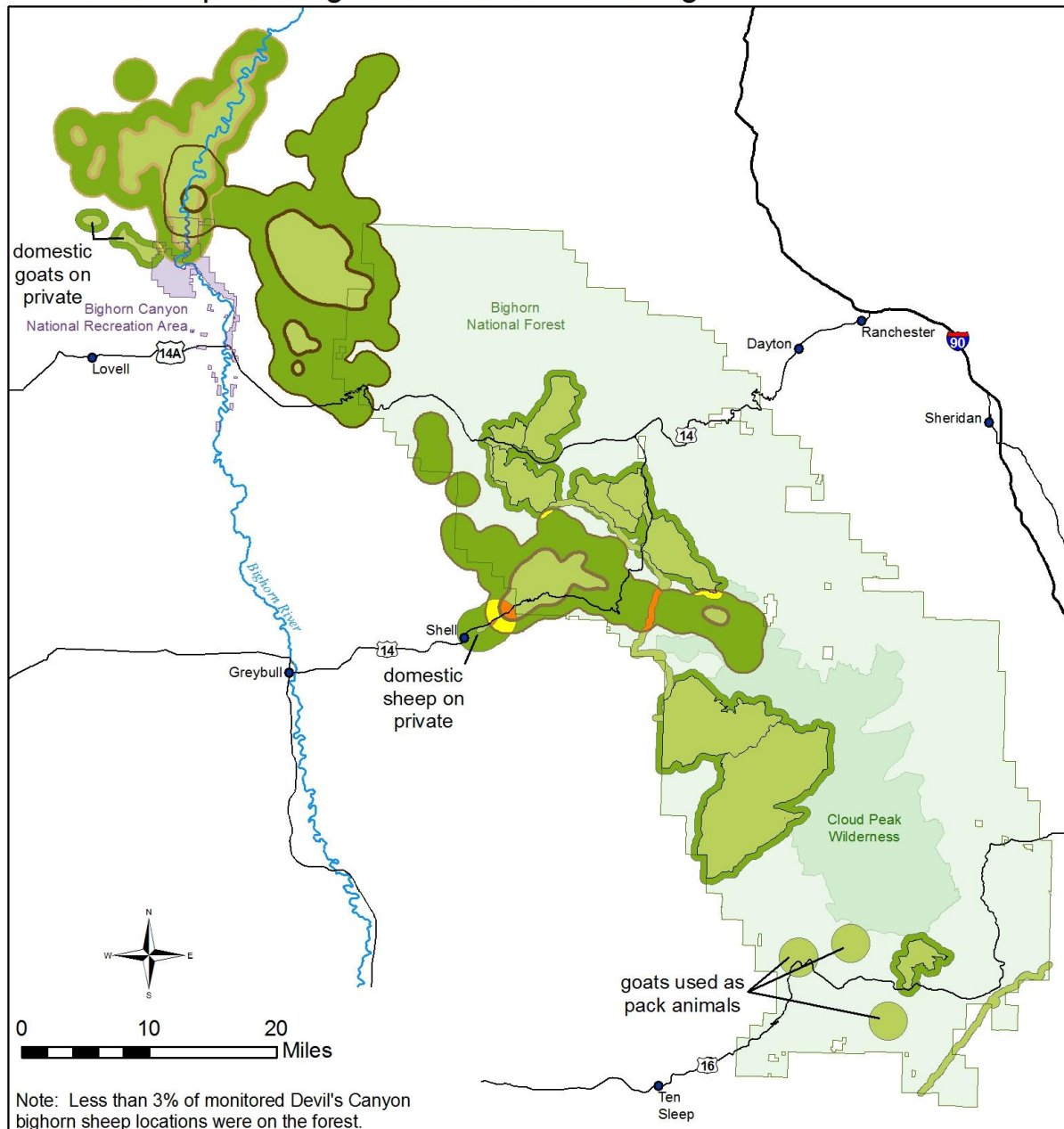
*Refer to document for definition.
6 does not occur in this scenario.

- Allotment Boundaries
- Devils Canyon Herd - 95% core area
- Devils Canyon Herd - 5% outer limit
- Shell Canyon Herd - 95% core area
- Shell Canyon Herd - 5% outer limit
- Bighorn Canyon Herd - 95% core area
- Bighorn Canyon Herd - 5% outer limit

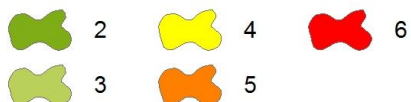
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Current Sheep Grazing on Forest outside of Big 6



Potential for Interaction*



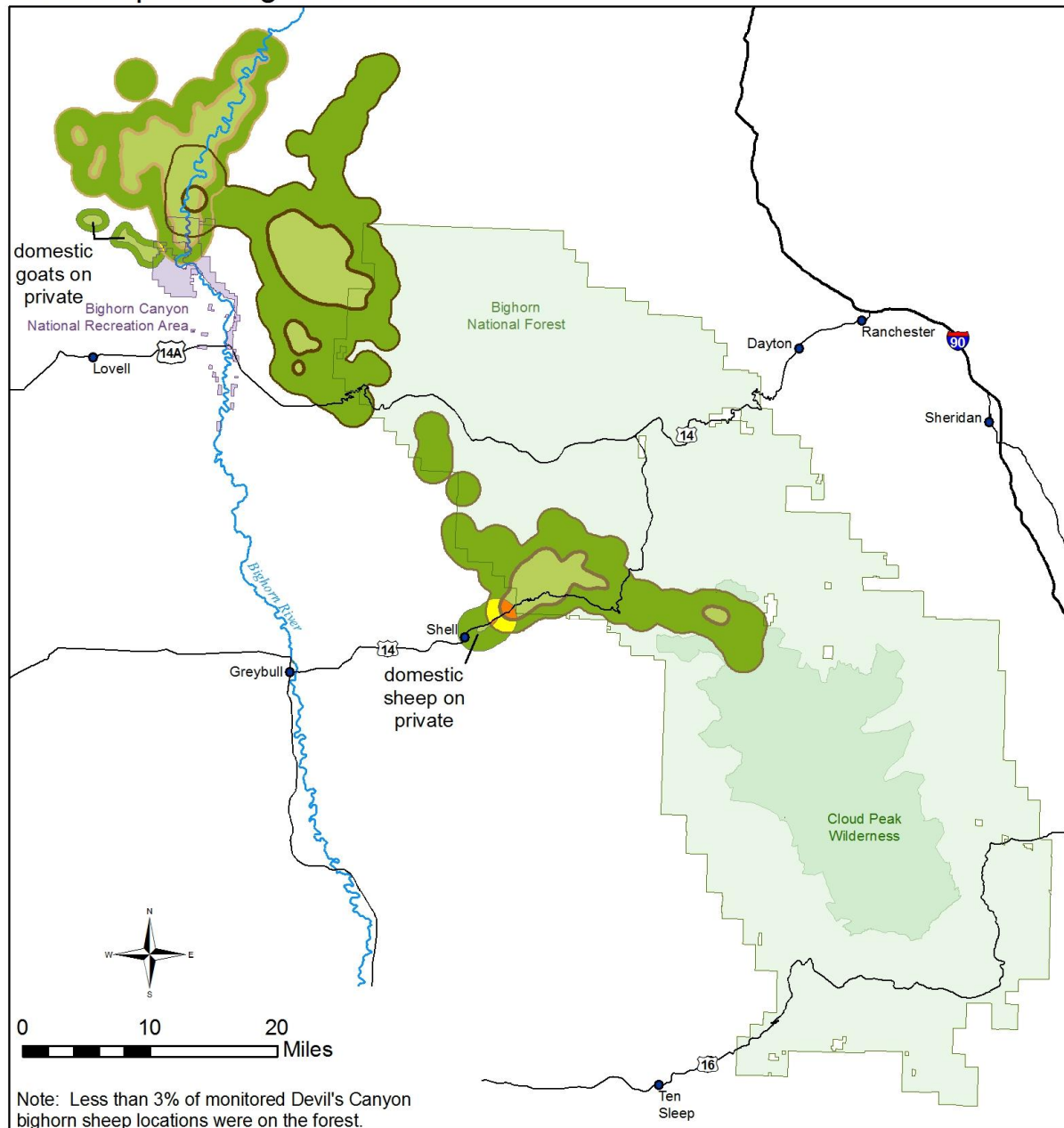
*Refer to document for definition.
6 does not occur in this scenario.

- Allotment Boundaries
- Devils Canyon Herd - 95% core area
- Devils Canyon Herd - 5% outer limit
- Shell Canyon Herd - 95% core area
- Shell Canyon Herd - 5% outer limit
- Bighorn Canyon Herd - 95% core area
- Bighorn Canyon Herd - 5% outer limit

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2010Dec10 amo

No Sheep Grazing on Forest



Potential for Interaction*



*Refer to document for definition.
6 does not occur in this scenario.

- Devils Canyon Herd - 95% core area
- Devils Canyon Herd - 5% outer limit
- Shell Canyon Herd - 95% core area
- Shell Canyon Herd - 5% outer limit
- Bighorn Canyon Herd - 95% core area
- Bighorn Canyon Herd - 5% outer limit

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2010Dec10 amo

GIS Overlay for Bighorn Sheep Risk Assessment – 12/10/2010

How the weights were determined is discussed on the following page.

Weight	GIS Layer	
3	Bighorn sheep 95% core area	For overlay analysis purposes, the three herds were dissolved into one layer, however there was no overlap of the Shell Canyon herd with either the Devils Canyon herd or the Bighorn Canyon herd.
3	Sheep allotments	For overlay analysis purposes, these layers were dissolved into one layer.
	Stock trailing routes (½ mile wide)	
	Bed grounds (½ mile radius) along stock trailing routes	
	Sheep on private	
	Goats on private	
	Goats on forest used for invasive or woody species control (2 pastures on NE portion of forest; 1 each in Sage Basin C&H and West Pass C&H)	
	Pack goats on Powder River Ranger District (1 ½ mile radius)	
2	Bighorn sheep 5% outer limit (does not include the 95% core area)	For overlay analysis purposes, the three herds were dissolved into one layer, however there was no overlap of the Shell Canyon herd with either the Devils Canyon herd or the Bighorn Canyon herd.
2	½ mile buffer around sheep allotments minus the stock trailing routes and bed grounds	For overlay analysis purposes, these layers were dissolved into one layer.
	1 ½ mile buffer around sheep on private	
	½ mile buffer around goats on private	

The overlay gave a range of values from 2-6:

- 2 Where there was only a bighorn sheep 5% outer limit area or only a buffer area around sheep allotments, around sheep on private, and around goats on private
- 3 Where there was only a bighorn sheep 95% core area or only the layer developed from the dissolve of the sheep allotments, stock trailing routes, bed grounds, sheep on private, goats on private, goats used for invasive/woody species control, and pack goats
- 4 Where a bighorn sheep 5% outer limit area overlapped with the layer developed from the dissolve of the buffer area around sheep allotments, buffer around sheep on private, and buffer around goats on private.

Scenarios that did occur:

Shell Canyon herd 5% outer limit area overlapped with the buffer around the sheep allotments

Shell Canyon herd 5% outer limit area overlapped the buffer around the sheep on private

Devils Canyon herd 5% outer limit area overlapped with the buffer around the goats on private

- 5 Where a bighorn 95% core area overlapped with the layer developed from the dissolve of the buffer area around sheep allotments, buffer around sheep on private, and buffer around goats on private **or** where a bighorn 5% outer limit area overlapped with the layer developed from the dissolve of the sheep allotments, stock trailing routes, bed grounds, sheep on private, goats on private, and pack goats.

Scenarios that did occur:

Shell Canyon herd 95% core area overlapped with the buffer around the sheep allotments.

Shell Canyon herd 95% core area overlapped with the buffer around the sheep on private.

Shell Canyon herd 5% outer limit area overlapped with sheep allotments.

Shell Canyon herd 5% outer limit area overlapped with a stock trailing route.

Devils Canyon herd 5% outer limit area overlapped with a stock trailing route.

Shell Canyon herd 5% outer limit area overlapped with the sheep on private.

- 6 Where a bighorn 95% core area overlapped with the layer developed from the dissolve of the sheep allotments, stock trailing routes, bed grounds, sheep on private, goats on private, and pack goats.

Scenario in which this occurred:

Under Big 6 alternative 2, where the Shell Canyon herd 95% core area overlapped the southwest corner of the Grouse S&G allotment.